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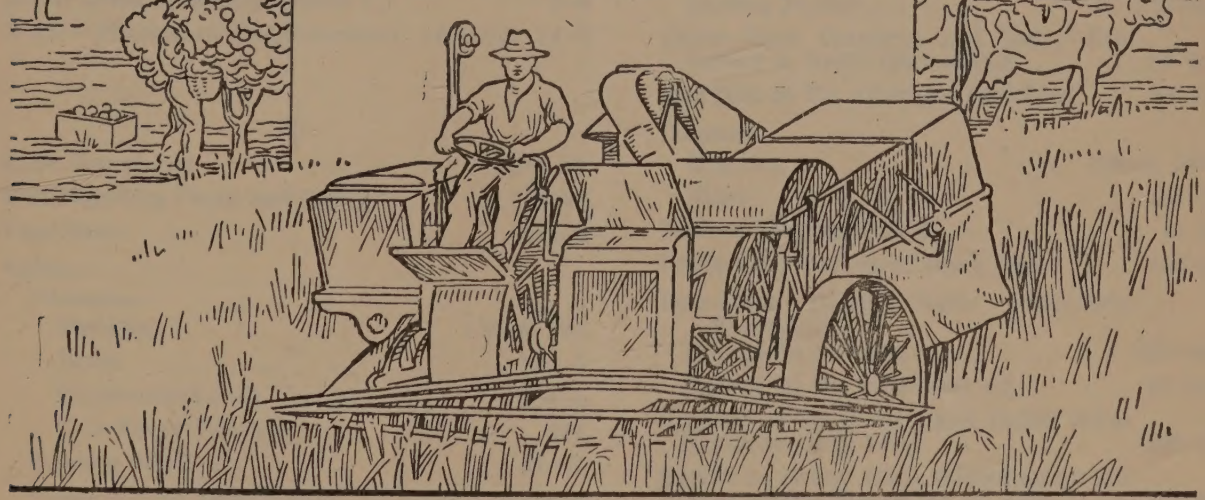
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C. W. WINDERS, B.Sc.Agr.



JANUARY, TO JUNE, 1953.

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MESSAGE FROM THE MINISTER.

«»

Another year of mixed fortunes for the man on the land has just ended. Its opening weeks saw the culmination of a drought that will long be remembered. Fortunately, the few months succeeding the breaking of the drought proved highly favourable to most industries, and though stress conditions were experienced late in the year, the land in general is in good heart and there is every confidence in the prospects for 1953.



Hon. H. H. Collins.

It is greatly to be hoped that the vicissitudes of the next few years will be small enough to be taken by the primary industries in their stride. There is a strong need not merely for sustained production but for increased production from Australia's chief asset, the land, if the nation's economy is to be stabilised.

In April last the Australian Agricultural Council, on which I am the Queensland representative, drew up a list of farm targets which were considered desirable and practicable of attainment. This State's production of several major primary products will have to be rapidly and substantially increased if the national targets are to be reached in good time. Impressive starts have already been made with wheat and sugar expansion, and other products will quickly follow suit if growers are given sufficient incentive.

The Department of Agriculture and Stock, in common with other State Departments concerned with primary production, is doing all it can to increase production and the efficiency of farming. In wishing primary producers a fruitful 1953, I invite them to make full use of the services of my Department.

H. H. Collins

Minister for Agriculture and Stock.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 31st DECEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S...	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus Stud," Greenmount
	H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, via Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmer " Stud, Wondai
	W. G. Marquardt, " Springlands," Wondai
	A. C. and C. R. Marquardt, " Cedar Valley," Wondai
	A. H. Sokoll, " Sunny Crest " Stud, Wondai
	W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, via Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	"St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, via Biggenden
Jersey	J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount
	J. F. Lau, " Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
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	W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood
	Queensland Agricultural High School and College, Lawes
	Estate of J. A. Scott, "Kiaora," Manumbar Rd., Nanango
	F. W. Verrall, "Coleburn," Walloon
Polled Hereford ..	W. Maller, " Boreview", Pickanjinnie

AGRICULTURE IN THE MARY VALLEY AND ADJOINING DISTRICTS.

The reference to topdressing of pastures in the article on the above subject which appeared in the December issue may have given some readers the impression that in a soil deficient in both lime and phosphate these deficiencies may be remedied by applying lime, dolomite or superphosphate. The position is that superphosphate is needed to correct phosphate deficiency and either lime or dolomite to correct lime deficiency.



Buffel Grass (Cenchrus ciliaris L.).

S. MARRIOTT (Senior Agrostologist) and K. B. ANDERSSEN (Adviser in Agriculture)

BUFFEL grass occurs naturally in various forms in tropical and sub-tropical portions of Africa and southern Asia. It was introduced from India to north-western Australia in 1915, and since that time a number of African and Asiatic strains have been tested in the various States of the Commonwealth. Further strains have been isolated in Africa; these are expected to be available for testing in Queensland in the near future.

The strain at present in commercial use in Queensland is doing well in areas as widely separated as the Burnett Valley (Plate 1), the Cooktown hinterland and the Cloncurry district (Plate 2).



Plate 1.

A Good Stand of Buffel Grass After Heavy Summer Grazing. This pasture is on softwood scrub country in the Gayndah district.

Native species of the same genus as buffel grass are found in Australia, but these are of very minor value compared with the introduced strains. Common ones are Mossman River grass (*Cenchrus echinatus*), whose spiny fruits make it a pest in coastal tropical Queensland, and *Cenchrus australis,* which is known as hillside burr grass.



Plate 2.

Buffel Grass on Broken Spinifex Grass Country in the Cloncurry District.

Description.

Variations in growth habit occur in buffel grass (Plates 3 and 4), but it can best be described as an erect, perennial grass of the tussock-forming type which produces short underground runners; this latter habit is more pronounced in some strains than in others. Great variation in leafiness also exists between strains. It is a characteristic of this grass that stems from which the leaf has been stripped will shoot at the nodes, producing clusters of very short foliage. These old stems become hard and wiry; therefore the grass should not be allowed to reach this stage for grazing purposes.



Plate 3.

Buffel Grass on a River Alluvial in the Peachester District.



Plate 4.

A Strain of Buffel Grass Under Test on Biloela Regional Experiment Station.

The seedheads, which are purplish when young but change to a brownish hue on maturity, are of a foxtail shape, and are borne on rather short stems. The large "seeds" bear a number of bristles, particularly at their bases. In well-grown fields, the seedheads may be ripe while the leaves are green and the plant still making fresh growth from the base.

Climatic Requirements.

Buffel grass is a summer-growing grass and is best adapted to summer-rainfall districts. The grass is very drought-resistant, and in Queensland is suited to areas with an average annual rainfall as low as 20 inches. It is also considered worthy of trial in drier areas provided low seeding rates are used to establish stands no thicker than the sparse native pastures. While it is subject to leaf damage by frosts, it makes quick regrowth during any warm spells in the winter months, and shoots vigorously in the spring.



Plate 5.

Harvesting Buffel Grass Seed by Hand in the Gayndah District.

Soils.

Buffel grass appears to thrive best on well-drained and fairly dry soils even though the fertility level may not be high. It does well on the deep, basaltic scrub soils of the Burnett Valley (Plate 1), but is also recommended for the sandy so-called desert country of central-western Queensland. In test plots it has failed to persist on some poorly drained clay soils in south-eastern Queensland, but in the lower rainfall areas does well on the heavy soils.

Seed.

Seed of buffel grass is available commercially, the main centre of production being the Gayndah district in the Central Burnett. Harvesting is done by hand (Plate 5), and as the ripe seedheads are easily distinguished, good samples can be obtained. Machine-harvesting

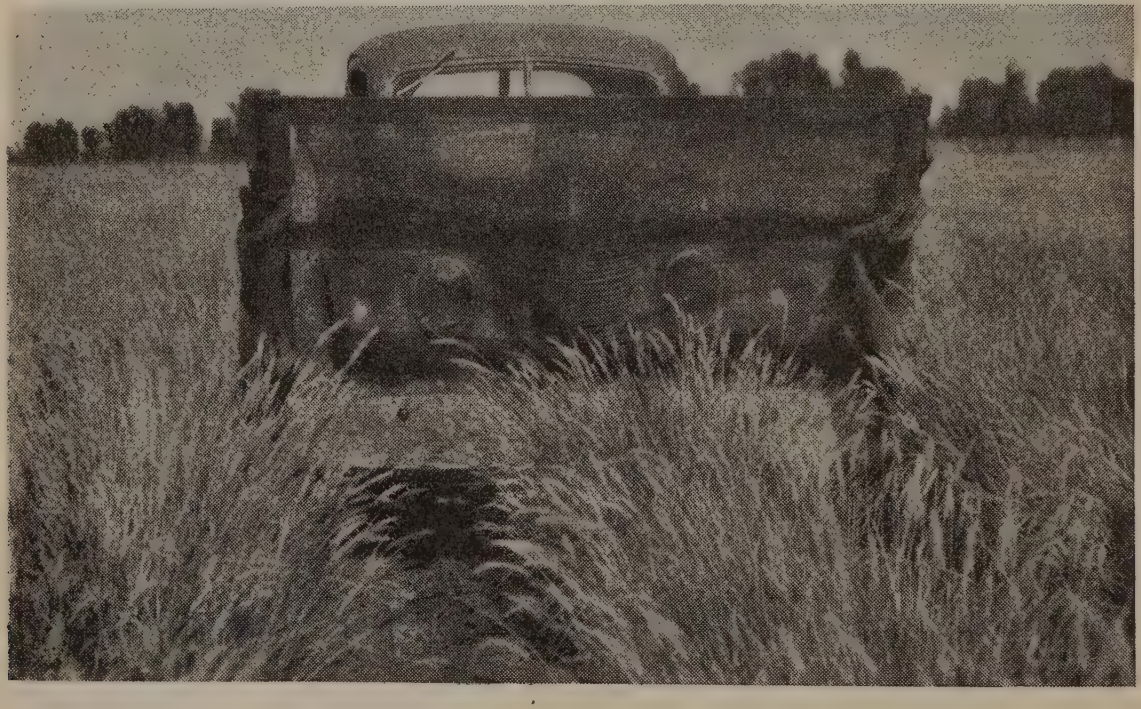


Plate 6.

Harvesting Buffel Grass Seed on a Tray Fitted in Front of a Utility Truck.

of this grass seed should present no difficulty. In the Central Burnett, a scoop fitted with stripper fingers has been used effectively when mounted on the front of a tractor or truck and driven through the seed crop at a speed of approximately 10 m.p.h. Even a tray on the bumper bar may suffice (Plate 6).

As with a number of other grass seeds, germination of buffel grass seed improves with storage. Samples collected and stored by the Department of Agriculture and Stock have shown the increases in seed germination set out in Table 1.

TABLE 1.

CHANGES IN GERMINATION PERCENTAGE OF BUFFEL GRASS SEED FOLLOWING STORAGE.

Sample No.	Germination at Harvest (March, 1949).	Germination in August, 1949.	Germination in August, 1952.
	%	%	%
1	3	67	82
2	11	43	46
3	5	32	30
4	18	72	74

Planting.

Buffel grass is readily established from seed, and as with most plants, the ease and speed of its establishment is closely correlated with the degree of soil preparation. Best stands are obtained from plantings made on well-prepared, fallowed land.

The seed may be broadcast in the ashes following scrub burns in brigalow, brigalow-belah or brigalow-softwood country. On cultivated land, broadcast seed should be lightly covered by harrows to a depth of half an inch to an inch.

In pastoral areas, the seed should be broadcast and if possible tramped into the soil by driving stock over the area. Pasture furrows can be used to provide the seedbed and in this way patches of the grass can be established through large paddocks. On sloping land, contour pasture furrows offer a useful seedbed for establishing the grass.

Small fenced areas sown on large properties can be used to provide a source of seed which may be distributed as desired. This grass has also shown distinct promise of being a good natural coloniser in open country provided it is allowed to set seed, but establishment in this way is necessarily slow.

Experience at Biloela Regional Experiment Station indicates that where machinery is available and soil erosion is not a problem, row cultivation of buffel grass may be worthwhile.

The light bristly "seeds" do not flow readily through a seed drill and are also difficult to broadcast. It is anticipated that hammer-mill treatment will remove most of the bristles and outer glumes or "husks" and leave the seed in a condition suitable for machine-sowing. Mixing with a large bulk of damp sawdust makes it easier to obtain an even distribution by broadcasting. Recommended planting rates vary from 4-5 lb. per acre on the coast to 2 lb. per acre in the 15-20 inch rainfall zone.

While no detailed information from local plots is available regarding suitable legumes for use in mixtures with buffel grass, lucerne at 1 lb. per acre in temperate or subtropical zones where the soil is suitable, or phasemy bean (*Phaseolus lathyroides*) at 1-2 lb. per acre, could be tried in all but the driest areas. Seed of the latter legume is not available commercially but can be collected by hand from natural stands which occur in many parts of south-eastern and central Queensland. In areas where frosts are not severe, Townsville lucerne (*Stylosanthes sundaica*) could be oversown without covering the seed, using 1-2 lb. per acre.

Planting may be carried out safely during spring and early summer, provided good rains are received, or during the wet season in February and March.

Management.

Buffel grass, once firmly established, can withstand heavy grazing and cutting. When it occurs in mixed pastures, buffel grass is often grazed in preference to other components of the mixture, and this may lead to its disappearance from the pasture or may hinder its further spread. Stocking should therefore be adjusted to overcome this.

Light grazing may result in undesirable stemmy growth with short, bunched leaf growth at the nodes (Plate 7). Such a condition can best be remedied by mowing or heavy grazing. Burning should not be used



Plate 7.

Buffel Grass in a Wiry Form When Left Ungrazed.

unless unavoidable. Where light stands only have been obtained, it is important that the grass be allowed to mature a seed crop before grazing.

Palatability.

The commercial strain of buffel grass is known to be very palatable and the chemical composition of samples so far tested indicates that its nutritive value is considerably superior to that of most native grasses. Results of some chemical analyses are given in Table 2.

TABLE 2.

CHEMICAL COMPOSITION OF BUFFEL GRASS AND QUEENSLAND BLUE GRASS (ON WATER-FREE BASIS).

Grass	Protein.	Fat.	Carbo-hydrate.	Fibre.	Ash.	CaO.	P_2O_5.	Remarks.
	%	%	%	%	%	%	%	
Buffel grass ..	18·0	1·6	40·7	27·0	12·7	·953	·670	Young growth
Buffel grass ..	5·6	1·2	52·8	30·4	10·0	·250	·154	Dry, stemmy plants
Buffel grass ..	8·3	0·8	43·7	38·5	8·7	·272	·157	Stemmy, leafy, in full seedhead with ripe seed
Queensland Blue grass	10·0	1·1	42·5	33·1	13·1	·544	·547	Green, in seed
Queensland Blue grass	3·9	1·0	47·6	36·4	11·1	·396	·334	In seed

Some samples examined have shown a protein value as high as 20 per cent.

It is reported that the grass makes hay of good quality. If it is established on open country, therefore, it could be a valuable source of bush hay, particularly in the lower rainfall areas.

Conclusion.

The growth of buffel grass over a wide range of climatic conditions in Queensland has shown such promise as to warrant its trial in all moderate to low rainfall zones in the State. It has displayed a high degree of drought-resistance, is palatable and has a good nutritive value. Where practicable, it should be treated as a crop and sown on a well prepared seedbed. However, it can also be established successfully in native pastures of the pastoral areas. The use of legumes such as lucerne, phasemy bean and Townsville lucerne in admixture with buffel grass is desirable and should be attempted wherever possible.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

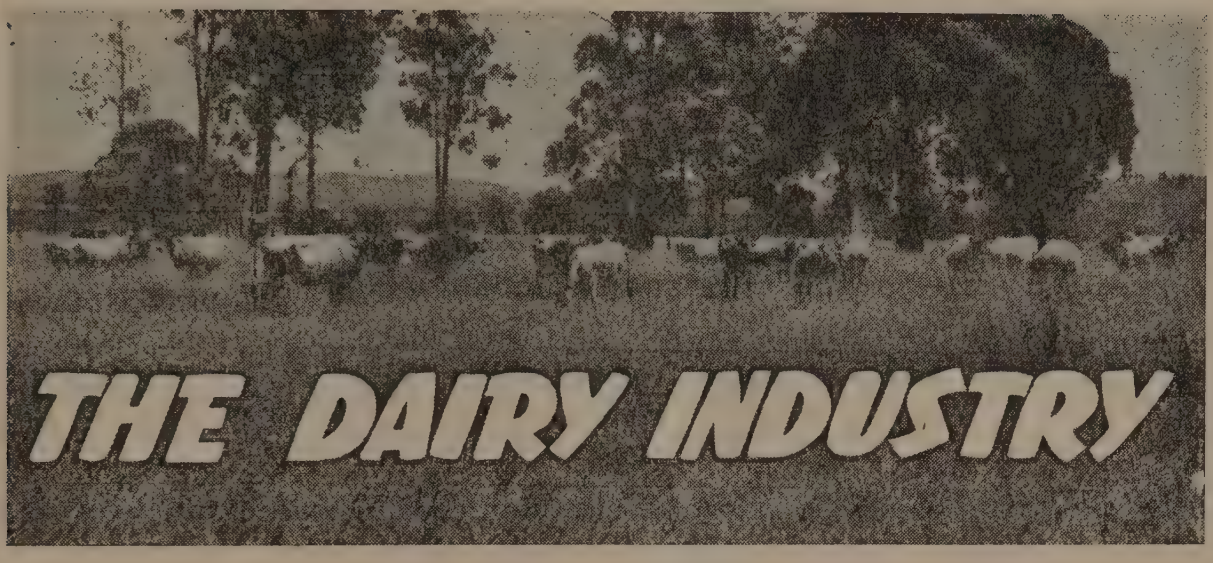
TESTED HERDS.

(AS AT 31st DECEMBER, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts Road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, "Rockthorpe" Stud, via Pittsworth
	F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie
	D. E. and E. C. Apelt, "Thelmur," Oakey
	Mrs. I. M. James, "Kenmore" Stud, Cambooya
	H. L. Stark, "Florida," Kalbar
	J. H. N. Stoodley, "Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, "Bardell", Goovigen.
	R. E. Paulsen, "Hillcrest" Stud, Binjour Plateau, M.S.670, Gayndah

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield F. L. Hayward, " Curyo," Jandowae J. A. Heading, " Highfields," Murgon K. B. Jones, " Cefn " Stud, Pilton R. G. Koplick, " Melan Terez " Stud, Rochedale R. Postle, " Yarralla " Stud, Pittsworth E. J. Bell, " Dorne " Stud, Chinchilla L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood J. H. G. Blakeney, " Talgai " Stud, Clifton H. R. Gibson, " Thistleton " Stud, Maleny H.M. State Farm, Numinbah K. A. Hancock, " Laurestonvale " Stud, Murgon O. H. Horton, Mannuem, Kingaroy V. P. McGoldrick, " Fairymeadow " Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, via Gympie E. B. Horne, "Kalringal," Wooroolin S. T. Fowler, "Kenstan" Stud, Pittsworth J. A. and J. McNicol, "Camden," Canning Vale, Warwick H. L. Larsen, "Oakway," Kingaroy C. Allison, "Colrene" Stud, Lake and Reserve Rds., Slacks Creek
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands N. R. Potter, " Actonvale " Stud, Wellcamp D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun A. C. Fletcher, " Myola " Stud, Jimbour Salvation Army Home for Boys, Riverview F. Thomas, M.S. 373, Beaudesert A. J. Surman, Noble Road, Goodna P. V. McKewin, "Wattleglen" Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, "Sunny View," M.S. 90, Kingaroy T. A. Stephen, "Withcott," Helidon W. F. Kajewski, "Glenroy" Stud, Glencoe A. A. Herbst, Bahr Scrub, via Beenleigh R. G. Koplick, " Melan Terez " Stud, Rochedale H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee D. Kay and P. Hunting, " Kazan " Stud, Goodna E. Sirrett, " Iona Vale " Stud, Kuraby C. R. Smith, " Belton Park " Stud, Nara H. H. Sellars, " Tabooba " Stud, Beaudesert H. Thomas, " Eurara " Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, " Glenbella " Stud, Silverleigh G. J. Cooper, "Cedar Glen", Yarraman J. B. Dunlop, Acacia Road, Kuraby A. Curd, Box 35, Jandowae C. Allison, "Colrene" Stud, Lake and Reserve Rds., Slacks Creek



Queensland Cheese Production, 1951-52

Prepared by the Division of Dairying.

THE drought of 1951-52 had a twofold effect on the production of cheese. In the first place, milk supplies to the factories fell to a low level. Secondly, cheese factories were called upon for a time to supply milk to Brisbane and other centres to make up deficiencies from the market milk supply areas. Production reached the lowest level recorded since the industry has been of major importance in Queensland.

Although quality was somewhat lower than in the previous year, the results achieved, having regard to the abnormal conditions, may be regarded as reasonably satisfactory.

SUMMARY.

Cheese Production.

Cheese Manufactured	10,528,124 lb. (4,700 tons).
Cheese Graded	4,050,357 lb. = 38·5% of manufacture.

Manufacturing Data.

Yield of Cheese per 100 lb. Milk	10·01 lb.
Yield of Cheese per lb. Butterfat	2·73 lb.
Average Butterfat Test of Milk	3·69%

Gradings.

—	lb.	%
Choice	22,047	·54
First	2,870,922	70·88
Second	1,120,454	27·66
Third	33,734	·83
Reject	3,200	·08

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1952.

Factory.	Milk Used for Cheese-making.	Production and Yield.					Official Gradings.					
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Submitted (lb.) and Percentage of Manufacture.	Choice.	First.	Second.	Third.	Reject.
				Per 100 lb. Milk.	Per lb. Butterfat.							
	lb.	lb.	lb.	lb.	lb.	%						
Biddeston	4,542,084	484,579	171,038	10·67	2·83	3·77	146,904	..	96,954	49,950	..	..
							30·3%	..	66·0%	34·0%	..	..
Coalstoun Lakes	1,823,205	192,471	71,040	10·56	2·71	3·9	28,484	..	..	28,484	..	..
							14·8%	..	..	..	..	..
Dare Bros. Pty., Daredale ..	566,725	51,121	20,127	9·02	2·54	3·55	40,525	..	..	37,798	2,727	..
							79·3%	..	..	93·27%	6·73%	..
Dare Bros. Pty. ,Woodleigh ..	869,713	80,329	31,841	9·24	2·52	3·66	56,989	..	16,589	34,483	5,277	640
							70·9%	..	29·11%	60·51%	9·26%	1·12%
Downs Association, Toowoomba	11,607,746	1,214,966	420,656	10·47	2·89	3·62	316,792	13,760	301,253	1,779	..	..
							26·1%	4·34%	95·09%	·56%	..	..
Dundarrah	707,138	72,938	27,772	10·31	2·63	3·93	4,654	..	..	4,654	..	..
							6·4%	..	..	..	..	..
Felton	2,991,453	305,872	111,548	10·22	2·74	3·73	84,472	..	74,546	12,926	..	..
							28·6%	..	85·22%	14·78%	..	..
Greenmount	1,852,509	196,838	68,670	10·63	2·87	3·71	3,640	..	..	3,640	..	..
							1·8%	..	..	..	..	..
Irongate	2,496,180	255,205	88,207	10·22	2·89	3·53	179,008	8,287	153,396	17,325	..	..
							70·1%	4·63%	85·69%	9·68%	..	..
Kooroongarra	1,402,834	129,515	48,236	9·23	2·69	3·44	126,155	..	98,640	27,515	..	..
							97·4%	..	78·19%	21·81%	..	..
Malling	3,826,829	353,041	134,997	9·23	2·62	3·53	No Gradings					
Maclagan Association, Maclagan	6,379,794	621,616	238,939	9·74	2·60	3·75	425,478	..	247,982	175,736	1,760	..
							68·4%	..	58·28%	41·3%	·41%	..
Maclagan Association, Kulpi ..	3,643,982	344,721	127,232	9·46	2·71	3·49	207,584	..	177,875	28,513	1,196	..
							60·2%	..	85·69%	13·74%	·57%	..
Maryborough Association, Tansey	4,324,543	425,246	177,566	9·83	2·39	4·11	4,068	..	4,068	..	..	..
							1%	..	..	..	..	..
Maxam Cheese Products, Cooranga North	3,937,238	402,654	153,425	10·23	2·62	3·9	190,660	..	138,013	45,542	5,985	1,120
							47·4%	..	72·39%	23·89%	3·14%	·59%
Maxam Cheese Products, Lilyvale	1,934,360	199,494	72,031	10·31	2·77	3·72	191,114	..	177,966	13,148	..	..
							95·8%	..	93·12%	6·88%	..	..
Moola	2,920,483	281,213	104,461	9·63	2·69	3·58	164,148	..	133,368	30,198	426	..
							58·4%	..	81·33%	18·41%	·26%	..
Mount Sibley	345,810	38,573	13,268	11·15	2·91	3·84	25,970	..	173	22,729	3,068	..
							67·3%	..	·67%	87·52%	11·81%	..
Mount Tyson	3,581,394	358,689	*131,142	10·02	2·74	3·66	21,396	..	18,042	3,354	..	..
							6·0%	..	84·32%	15·68%	..	..
Pittsworth Association, Pittsworth	6,736,730	690,240	251,452	10·25	2·75	3·73	196,236	..	186,222	10,014	..	..
							28·4%	..	94·9%	5·1%	..	..

Pittsworth Association, Linthorpe	1,305,747	135,466	48,644	10·37	2·78	3·73	124,358	..	41,651	82,707	..	..
							91·8%	..	33·49%	66·51%	..	..
Pittsworth Association, Yarranlea	1,502,984	145,551	53,931	9·68	2·70	3·59	61,246	..	17,014	43,377	855	..
							42·1%	..	27·78%	70·82%	1·4%	..
Port Curtis Association, Bracewell	1,757,770	184,964	66,645	10·52	2·78	3·79	No Gradings					
Q.A.H.S. and College, Lawes ..	43,140	4,525	1,774	10·49	2·55	4·11	No Gradings					
Quinalow	5,231,675	531,338	187,812	10·16	2·83	3·59	No Gradings					
Ramsay	527,535	50,020	18,641	9·48	2·68	3·53	59,670	..	..	59,670	..	..
							100·00%	..	..	..	..	..
Rockview	1,735,829	175,717	65,248	10·12	2·69	3·76	158,006	..	149,615	8,391	..	..
							89·9%	..	94·69%	5·31%	..	..
Rocky Creek	1,635,715	159,834	56,308	9·77	2·84	3·44	144,101	..	79,220	64,881	..	..
							90·2%	..	54·98%	45·02%	..	..
Southbrook	3,632,973	366,658	129,440	10·09	2·83	3·56	170,799	..	122,044	48,755	..	..
							46·6%	..	71·45%	28·55%	..	..
South Burnett Association, Murgon	n.a.	70,474	n.a.	..	..	..	No Gradings					
South Burnett Association, Goomeri	n.a.	297,685	n.a.	..	..	..	232,035	..	202,180	29,855	..	..
							77·9%	..	87·13%	12·87%	..	..
Sugarloaf	1,256,803	125,275	49,231	9·97	2·54	3·92	88,608	..	19,249	69,359	..	..
							70·7%	..	21·72%	78·28%	..	..
Sunnyvale	922,410	92,855	37,862	10·07	2·45	4·1	22,597	..	3,407	18,710	480	..
							24·3%	..	15·08%	82·8%	2·12%	..
Warwick Association, Greymare..	877,350	84,804	32,320	9·67	2·62	3·68	No Gradings					
Warwick Association, Talgai ..	376,292	38,250	*14,842	10·16	2·58	3·94	No Gradings					
Warwick Association, Victoria Hill	701,580	68,576	25,291	9·77	2·71	3·6	No Gradings					
Warwick Association, Mill Hill ..	8,289,281	854,650	309,368	10·31	2·76	3·73	292,229	..	288 165	4,064	..	..
							34·2%	..	98· 1%	1·39%	..	..
Yamsion	1,126,655	114,463	39,805	10·16	2·88	3·53	93,680	..	1· 000	63,680	10,560	1,440
							81·8%	..	19·21%	67·98%	11·27%	1·54%
Yargullen	3,199,176	320,927	116,446	10·03	2·76	3·64	185,751	..	105,134	79,217	1,400	..
							57·9%	..	56·60%	42·65%	·75%	..

*Estimated

Queensland Butter Production, 1951-52.

Prepared by the Division of Dairying.

THE drought of 1951-52 had a very serious effect on dairy production in Queensland. Butter production was the lowest for many years and was even substantially below that of 1946-47, which also was a drought year.

The official gradings of butter show that quality was somewhat lower than in the previous year. This was caused largely by infrequent and irregular deliveries of cream to factories, which was brought about by the low volume of supplies. Most factories for a time received cream only twice a week. Inadequate farm water supplies also contributed to the poorer quality of cream reaching the factories.

SUMMARY.

Butter Production.

Butter Manufactured	62,385,094 lb. (27,850 tons)
Commercial Butter Equivalent of Cream Sold ..	248,326 lb. (111 tons)

Manufacture in Grades.

	lb.	%
Choice	44,353,502	71·10
First	16,317,434	26·16
Second	1,699,990	2·72
Pastry	14,168	·02
Total	62,385,094	100·00

Payment to Suppliers (in Grades).

(Including payment for cream sold as fresh cream.)

	lb.	%
Choice	40,653,129	64·93
First	20,446,701	32·66
Second	1,506,207	2·40
Pastry	6,355	0·01
Total	62,612,392	100·00

Official Grading.

(Submitted for grading—689,699 boxes of 1,114,020 boxes manufactured.)

Factory Grading.			Grading by State and Commonwealth Graders.				
Grade.	Boxes.	%	Choice.	First.	Second.	Pastry.	Prohibited From Export.*
			Boxes.	Boxes.	Boxes.	Boxes.	Boxes.
Choice ..	396,020	57·41	237,116	157,351	933	393	227
First ..	264,935	38·41	..	244,761	19,108	380	686
Second ..	28,532	4·14	..	..	21,187	6,971	374
Pastry ..	212	·03	..	..	..	212	..
Total ..	689,699		237,166 (34·4%)	402,112 (58·3%)	41,228 (6·0%)	7,956 (1·1%)	1,287 (0·2%)

* Does not include prohibitions for over-moisture, short-weight, bad finish, etc.

TABLE 1.

FACTORY PRODUCTION AND PAYMENTS, 1951–52.

Factory.	—	Manufacture and Payments.					Over-run.
		Total.	Choice.	First.	Second.	Pastry.	
		lb.	lb.	lb.	lb.	lb.	%
Atherton Tableland, Malanda ..	Make	1.815,604	1,815,604	..	..	..	..
	Pay	1,816,764	1,816,764	..	..	..	3·92
Caboolture Association, Caboolture ..	Make	1,769,058	1,629,451	139,607	..	..	..
	Pay	1,775,243	1,643,563	129,866	1,814	..	4·4
Caboolture Association, Eumundi ..	Make	1,373,058	1,229,306	143,752	..	..	..
	Pay	1,370,360	1,247,470	122,256	634	..	3·72
Caboolture Association, Pomona ..	Make	993,547	903,359	88,936	1,252	..	..
	Pay	993,341	945,757	47,064	520	..	3·57
Chinchilla	Make	1,139,679	569,543	467,152	93,688	9,296	..
	Pay	1,140,026	461,730	583,012	89,083	6,201	2·92
Daintree	Make	80,548	..	80,548	..	..	..
	Pay	80,548	..	80,548	..	..	3·66
Dayboro	Make	86,680	..	86,680	..	..	..
	Pay	95,695	94,727	968	..	..	..
Downs Association, Clifton	Make	795,648	547,344	245,672	2,632	..	..
	Pay	795,696	545,577	247,695	2,424	..	3·37
Downs Association, Crow's Nest ..	Make	918,904	456,680	462,168	56	..	..
	Pay	918,918	446,322	470,298	2,298	..	2·97
Downs Asssociation, Dalby	Make	1,190,110	752,078	417,200	20,832	..	..
	Pay	1,190,856	752,934	423,845	14,077	..	2·08
Downs Association, Goombungee ..	Make	1,070,104	794,080	276,024	..	..	..
	Pay	1,070,081	784,022	286,059	..	..	1·29
Downs Association, Jandowae ..	Make	1,137,974	576,854	496,552	64,568	..	..
	Pay	1,138,120	579,281	495,351	63,488	..	2·59
Downs Association, Miles	Make	391,180	132,888	190,652	67,640	..	..
	Pay	391,537	133,008	190,837	67,692	..	2·92
Downs Association, Toowoomba ..	Make	1,628,923	1,423,047	84,112	121,764	..	..
	Pay	1,725,671	1,525,905	83,269	116,497	..	2·87
Esk	Make	1,409,516	842,348	567,168	..	..	..
	Pay	1,409,757	788,098	617,815	3,844	..	3·55
Evelyn Tableland Association, Ravenshoe	Make	419,601	419,601	..	..	..	..
	Pay	420,082	419,985	17	80	..	4·31
Gayndah	Make	816,832	546,520	270,312	..	..	..
	Pay	816,516	556,165	260,145	206	..	4·42
Killarney	Make	1,057,258	856,050	170,296	30,912	..	..
	Pay	1,057,217	747,216	288,183	21,818	..	2·01
Logan and Albert Association, Beaudesert	Make	2,122,325	1,515,621	606,704	..	..	..
	Pay	2,122,083	1,560,564	559,662	1,857	..	3·38
Maleny	Make	1,800,634	1,688,466	112,168	..	..	..
	Pay	1,801,130	1,669,821	130,440	869	..	2·97
Maryborough Association, Biggenden	Make	929,771	481,899	446,248	1,624	..	..
	Pay	930,699	415,555	513,039	2,105	..	3·34
Maryborough Association, Kingaroy	Make	2,167,489	1,922,769	168,448	76,272	..	..
	Pay	2,166,687	1,741,821	369,664	55,202	..	4·51
Maryborough Association, Maryborough	Make	424,828	332,669	92,259	..	..	..
	Pay	421,061	298,640	121,774	647	..	5·32
Maryborough Association, Mundubbera	Make	1,461,530	809,806	596,004	55,720	..	..
	Pay	1,461,302	785,018	627,878	48,406	..	3·67
Maryborough Association, Wondai ..	Make	1,351,226	911,514	402,920	36,792	..	..
	Pay	1,354,279	912,486	416,949	24,844	..	3·08
Millaa Millaa	Make	829,008	829,008	..	..	..	..
	Pay	838,698	838,698	..	..	..	1·31
Millmerran	Make	649,382	332,758	257,040	59,584	..	..
	Pay	649,357	304,920	304,142	40,295	..	2·59
Nanango	Make	1,616,736	593,898	966,222	56,616	..	..
	Pay	1,616,847	586,636	985,425	44,786	..	1·98
Oakey	Make	2,360,780	1,917,428	355,768	87,584	..	..
	Pay	2,361,657	1,785,656	511,156	64,845	..	2·93
Port Curtis Association, Biloela ..	Make	2,276,273	2,143,945	126,112	5,432	784	..
	Pay	2,276,359	868,556	1,403,070	4,733	..	2·17
Port Curtis Association, Bundaberg..	Make	958,418	277,384	681,034	..	..	..
	Pay	962,693	274,500	686,159	2,034	..	2·74
Port Curtis Association, Gladstone ..	Make	1,624,098	900,970	614,208	108,920	..	..
	Pay	1,642,119	432,154	1,116,302	93,663	..	2·83
Port Curtis Association, Mackay ..	Make	380,278	82,677	297,601	..	..	..
	Pay	384,432	85,041	294,363	5,028	..	2·29
Port Curtis Association, Monto ..	Make	1,969,277	1,535,746	425,656	7,875	..	..
	Pay	1,969,405	1,071,755	889,787	7,863	..	2·18
Port Curtis Association, Wowan ..	Make	1,382,415	1,229,031	148,400	952	4,032	..
	Pay	1,382,614	299,757	1,062,729	20,128	..	2·78
Q.A.H.S. and College, Lawes ..	Make	50,848	50,848	..	..	..	..
	Pay	50,820	43,473	5,445	1,902	..	1·87
Queensland Farmers Association, Boonah ..	Make	2,409,540	863,709	1,455,392	90,439	..	..
	Pay	2,409,618	781,270	1,558,468	69,880	..	3·15
Queensland Farmers Association, Booval	Make	1,795,747	1,240,853	384,260	170,578	56	..
	Pay	1,808,306	1,245,376	427,409	135,521	..	2·57
Queensland Farmers Association, Grantham	Make	1,469,332	513,969	951,443	3,920	..	..
	Pay	1,469,498	533,595	932,594	3,309	..	1·76
Queensland Farmers Association, Laidley	Make	1,258,532	659,348	566,477	32,707	..	..
	Pay	1,257,308	676,122	557,236	23,950	..	4·88
Queensland Farmers Association, Lowood	Make	467,283	124,632	338,514	4,137	..	..
	Pay	467,146	125,891	338,338	2,917	..	2·12

TABLE 1.—*continued.*

FACTORY PRODUCTION AND PAYMENTS, 1951–52.—*continued.*

Factory.	—	Manufacture and Payments.					Over-run.
		Total.	Choice.	First.	Second.	Pastry.	
		lb.	lb.	lb.	lb.	lb.	lb.
Roma	Make	261,394	..	261,394	..	..	..
	Pay	261,394	57,113	168,979	35,148	154	3·45
South Burnett Association, Murgon..	Make	1,385,212	1,071,108	289,968	24,136	..	..
	Pay	1,385,205	1,091,134	286,229	7,842	..	3·0
South Burnett Association, Proston ..	Make	755,216	605,360	148,736	1,120	..	..
	Pay	735,552	559,794	173,838	21,120	..	3·38
South Queensland Association, Kingston	Make	2,416,015	1,714,447	626,192	75,376	..	..
	Pay	2,469,940	1,686,236	715,798	67,906	..	3·17
Stanley River, Woodford	Make	802,025	665,597	136,428	..	..	..
	Pay	807,480	689,833	116,694	953	..	1·93
Warwick Association, Warwick ..	Make	837,625	813,756	8,512	15,357	..	..
	Pay	844,571	715,567	120,401	8,603	..	3·22
Warwick Association, Allora ..	Make	961,163	914,350	16,886	29,927	..	..
	Pay	961,145	851,865	82,098	27,182	..	2·91
Warwick Association, Inglewood ..	Make	221,479	211,140	8,659	1,680	..	..
	Pay	221,512	90,785	128,630	2,097	..	3·43
Warwick Association, Texas	Make	83,582	..	83,582	..	..	..
	Pay	83,552	..	83,552	..	..	2·54
Wide Bay Association, Cooroy ..	Make	880,027	634,635	216,552	28,840	..	..
	Pay	879,993	728,699	140,726	10,568	..	3·61
Wide Bay Association, Gympie ..	Make	3,931,382	3,269,408	340,816	321,158	..	..
	Pay	3,931,502	3,356,177	290,516	284,809	..	3·03

TABLE 2.

OFFICIAL GRADINGS, 1951–52.

Factory.	Boxes Submitted and Percentage of Make.	Grading.*					
			Choice.	First.	Second.	Pastry.	Prohibite Export.
Atherton Tableland, Malanda			No Butter Submitted for Grading				
Caboolture Association, Caboolture	12,071	a	9,398	2,673	—	—	
	38·2%		77·9%	22·1%			
		b	5,317	6,545	209		
			44·0%	54·2%	1·7%		
Caboolture Association, Eumundi	18,879	a	16,386	2,452	41		
	77%		86·8%	13·0%	·2%		
		b	8,364	9,236	969	115	195
			44·3%	48·9%	5·1%	·7%	1·0%
Caboolture Association, Pomona	15,150	a	13,134	1,994	—	—	
	85·4%		86·7%	13·2%			
		b	5,102	8,898	897	96	157
			33·7%	58·7%	5·9%	·6%	1·0%
Chinchilla	9,730	a	821	6,940	1,757	212	
	47·8%		8·4%	71·3%	18·1%	2·2%	
		b	701	5,551	2,676	802	
			7·2%	57·1%	27·5%	8·2%	
Daintree			No Butter Submitted for Grading				
Dayboro	758	a		758			
	49·0%						
		b		590	168		
				77·8%	22·2%		
Downs Association, Clifton	10,900	a	6,472	4,381	47		
	76·7%		59·4%	40·2%	·4%		
		b	4,927	5,664	262	47	
			45·2%	52·0%	2·4%	·4%	
Downs Association, Crow's Nest	14,907	a	6,697	8,209	1		
	90·8%		44·9%	55·1%			
		b	5,060	9,569	278		
			33·9%	64·2%	1·8%		
Downs Association, Dalby	11,272	a	3,505	7,407	360		
	53·0%		31·1%	65·7%	3·2%		
		b	2,780	7,971	317	204	
			24·7%	70·7%	2·8%	1·8%	
Downs Association, Goombungee	13,179	a	8,194	4,895	90		
	69·0%		62·2%	37·1%	·7%		
		b	4,248	8,708	223		
			32·2%	66·1%	1·7%		
Downs Association, Jandowae	18,058	a	8,459	8,523	1,076		
	88·9%		46·8%	47·2%	6·0%		
		b	7,450	8,681	1,524	403	
			41·3%	48·1%	8·4%	2·2%	

* a = grades into which the butter was manufactured and packed at the factory.
b = gradings by official State and Commonwealth graders.

TABLE 2.

OFFICIAL GRADINGS, 1951–52.

Factory.	Boxes Submitted and Percentage of Make.		Grading.*				
			Choice.	First.	Second.	Pastry.	Prohibited Export.
Downs Association, Miles	4,153	a	104	2,861	1,188		
	59·5%		2·5%	68·9%	28·6%		
		b	104	2,357	1,433	259	
			2·5%	36·8%	34·5%	6·2%	
Downs Association, Toowoomba	5,202	a	1,689	1,509	2,004		
	17·9%		32·5%	29·0%	38·5%		
		b	1,500	1,698	1,903	101	
			29·0%	32·6%	36·6%	1·9%	
Esk	22,135	a	12,172	9,963			
	87·9%		55·0%	45·0%			
		b	4,776	17,276	83		
			21·6%	78·0%	·4%		
Evelyn Tableland Association, Ravenshoe			No Butter Submitted for Grading				
Gayndah	12,482	a	7,740	4,742			
	85·6%		62·0%	38·0%			
		b	4,200	7,410	857	2	13
			33·6%	59·4%	6·9%		·1%
Killarney	5,311	a	1,886	2,967	458		
	28·1%		35·5%	55·9%	8·6%		
		b	1,638	3,182	348	143	
			30·8%	59·9%	6·6%	2·7%	
Logan and Albert Association, Beaudesert	34,556	a	23,662	10,881	13		
	91·2%		68·5%	31·5%			
		b	11,298	22,519	591	13	135
			32·7%	65·2%	1·7%		·4%
Maleny	27,401	a	25,422	1,979			
	85·2%		92·8%	7·2%			
		b	15,562	11,652	187		
			56·8%	42·5%	·7%		
Maryborough Association, Biggenden	10,169	a	2,042	8,098	29		
	61·2%		20·1%	79·6%	·3%		
		b	1,136	7,495	1,245	153	140
			11·2%	73·7%	12·2%	1·5%	1·4%
Maryborough Association, Kingaroy	7,197	a	2,701	3,163	1,333		
	18·6%		37·5%	43·9%	18·5%		
		b	2,135	3,729	921	412	
			29·7%	51·8%	12·8%	5·7%	
Maryborough Association, Maryborough	1,232	a		1,232			
	16·2%						
		b		983	249		
				79·8%	20·2%		
Maryborough Association, Mundubbera	20,270	a	8,739	10,541	990		
	77·7%		43·1%	52·0%	4·9%		
		b	5,161	14,119	659	207	124
			25·5%	69·7%	3·3%	1·0%	·6%
Maryborough Association, Wondai	12,612	a	4,956	6,974	682		
	52·3%		39·3%	55·3%	5·4%		
		b	3,082	7,974	1,250	306	
			24·4%	63·2%	1·0%	·2%	
Millmerran	7,633	a	2,224	4,406	1,003		
	65·8%		29·1%	57·7%	13·1%		
		b	881	5,348	834	570	
			11·5%	70·1%	10·9%	7·5%	
Nanango	25,897	a	8,148	16,784	965		
	89·7%		31·5%	64·8%	3·7%		
		b	3,487	19,283	2,703	306	118
			13·5%	74·5%	10·4%	1·2%	·5%
Oakey	35,879	a	27,963	6,352	1,564		
	85·1%		77·9%	17·7%	4·4%		
		b	15,693	18,465	1,569	152	
			43·7%	51·5%	4·4%	·4%	
Port Curtis Association, Biloela	20,769	a	18,909	1,763	97		
	51·1%		91·0%	8·5%	·5%		
		b	14,540	5,876	198	70	85
			70·0%	28·3%	1·0%	·3%	·4%
Port Curtis Association, Bundaberg	7,078	a		7,078			
	41·4%						
		b		7,078			
Port Curtis Association, Gladstone	16,747	a	4,058	10,913	1,776		
	57·7%		24·2%	65·2%	10·6%		
		b	1,931	11,735	2,600	394	87
			11·5%	70·1%	15·5%	2·4%	·5%
Port Curtis Association, Mackay			No Butter Submitted for Grading				

* a = grades into which the butter was manufactured and packed at the factory.
b = gradings by official State and Commonwealth graders.

TABLE 2.

OFFICIAL GRADINGS, 1951–52.

Factory.	Boxes Submitted and Percentage of Make.		Grading.* Choice.	First.	Second.	Pastry.	Prohibited Export.
Port Curtis Association, Monto	23,650 67·3%	a	16,648 70·4%	6,887 29·1%	115 ·5%		
		b	14,738 62·3%	8,729 36·9%	183 ·8%		
Port Curtis Association, Wowan	4,965 20·1%	a	2,715 54·7%	2,233 45·0%	17 ·3%		
		b	2,015 40·6%	2,880 58·0%	70 1·4%		
Q.A.H.S. College, Lawes			No Butter Submitted for Grading				
Queensland Farmers Association, Boonah	39,368 91·5%	a	12,274 31·2%	25,500 64·8%	1,594 4·0%		
		b	7,137 18·1%	30,457 77·4%	1,514 3·8%	260 ·7%	
Queensland Farmers Association, Booval	9,797 30·6%	a	138 1·4%	6,772 69·1%	2,887 29·5%		
		b	90 ·9%	6,539 66·7%	725 7·4%	105 1·1%	
Queensland Farmers Association, Grantham	22,504 85·8%	a	6,028 26·8%	16,406 72·9%	70 ·3%		
		b	750 3·3%	20,619 91·7%	1,135 5·0%		
Queensland Farmers Association, Laidley	19,592 87·2%	a	9,271 47·3%	9,762 49·8%	559 2·9%		
		b	3,487 17·8%	15,173 77·4%	716 3·7%	216 1·1%	
Queensland Farmers Association, Lowood	7,030 84·2%	a	868 12·3%	6,096 86·7%	66 ·9%		
		b	270 3·8%	6,447 91·7%	274 3·9%	39 ·6%	
Roma			No Butter Submitted for Grading				
South Burnett Association, Murgon	21,133 85·4%	a	15,742 74·5%	5,001 23·7%	390 1·8%		
		b	4,308 20·4%	15,460 73·2%	1,165 5·5%	200 ·9%	
South Burnett Association, Proston	12,465 92·4%	a	10,044 80·6%	2,421 19·4%			
		b	6,406 51·4%	5,109 41·0%	517 4·1%	433 3·5%	
South Queensland Association, Kingston	41,806 96·9%	a	29,634 70·9%	10,862 26·0%	1,310 3·1%		
		b	27,324 65·4%	13,172 31·5%	1,272 3·0%	38 ·1%	
Stanley River Association, Woodford	11,323 79·1%	a	8,971 79·2%	2,352 20·8%			
		b	2,518 22·2%	8,624 76·1%	181 1·6%		
Warwick Association, Allora	2,272 13·2%	a	1,440 63·4%	310 13·6%	522 23·0%		
		b	—	1,440 63·4%	700 30·8%	132 5·8%	
Warwick Association, Inglewood	206 5·2%	a	—	176 85·4%	30 14·6%		
		b	—	—	176 85·4%	30 14·6%	
Warwick Association, Texas			No Butter Submitted for Grading				
Warwick Association, Warwick	1,270 8·5%	a	858 67·6%	136 10·7%	276 21·7%		
		b	—	899 70·8%	326 25·7%	45 3·5%	
Wide Bay Association, Cooroy	13,355 85·0%	a	8,907 66·7%	3,933 29·4%	515 3·9%		
		b	3,581 26·8%	8,557 64·1%	1,032 7·7%	165 1·2%	20 ·2%
Wide Bay Association, Gympie	58,310 83·1%	a	47,001 80·6%	5,650 9·7%	5,659 9·7%		
		b	33,419 57·3%	18,415 31·6%	5,450 9·3%	918 1·6%	108 ·2%

* a=grades into which the butter was manufactured and packed at the factory.
b=gradings by official State and Commonwealth graders.

The Dairying Industry on the Atherton Tableland.

W. F. MAWSON, Adviser in Cattle Husbandry.

THIS article is an account of the dairying industry within the shires of Atherton and Eacham, on the Atherton Tableland in North Queensland (Plate 1). These shires are separated from the coastal plain by the Bellenden Ker Range and bounded on the west by the Great Dividing Range. They embrace the greater portion of the Tableland which forms the hinterland of the coastal area between Innisfail and Cairns, and are located between 17° and 18° south latitude and 145° and 146° east longitude at an elevation of between 2,000 ft. and 3,000 ft. above sea level.

The Tableland runs roughly parallel to the coastline and narrows as it extends northwards to a point about 40 miles from the coast. The shires of Atherton and Eacham embrace the main dairying lands north of Mackay, although the districts of Evelyn and Ravenshoe, in the adjoining Herberton shire, are important dairying areas and smaller centres occur at Julatten, north-west of Mareeba, and on the Daintree River 70 miles north of Cairns.

An area of 680 square miles is included within Atherton and Eacham shires and it supports a population of about 9,000 people. The main centres included are Atherton, Malanda, Millaa Millaa, Yungaburra, Peeramon, Tolga, Kairi, Kulara, Topaz, Butcher's Creek, Jaggan, Minbun, Tarzali, Barrine, North Johnstone, Danbulla, East Barron and Upper Barron.

Dairying began about the beginning of this century when men and their cattle from the North Coast of New South Wales arrived by boat. The first butter factory was established near Atherton, but was abandoned in 1923 when its branch factory at Malanda became the main factory of the Atherton Tableland Co-operative Butter Association Limited. A factory was opened at Millaa Millaa in 1930.

In addition to manufacturing butter, these two factories supply wholemilk to areas as far south as Townsville and as far west as Mount Isa. In normal seasons, some of the butter manufactured is exported. Sales of butter and wholemilk amount to over £500,000 annually.

Three other organisations transport wholemilk to Cairns, the milk being picked up at the farms and either taken direct to Cairns or pre-treated at a depot on the Tableland.

The area is served by a rail connection with Cairns. One line extends through Atherton into the adjoining shire of Herberton to terminate at Ravenshoe. A branch line from Tolga passes through Kairi, Kulara, Yungaburra, Peeramon, Malanda, Tarzali and Minbun to terminate at Millaa Millaa. Both passenger rail motors and goods trains provide regular services.

There are three main highways, mainly bitumen-sealed, to the coast. One via Kuranda is the shortest route from Cairns to Atherton (62 miles). The Gillies Highway runs from Gordonvale to Yungaburra, and the Palmerston Highway connects Innisfail with Millaa Millaa.



Plate 1.

Sketch Map of the Atherton Tableland.

The Tableland itself is well served by a network of roads, many of which are of bitumen and few of which ever become impassable after rain.

TOPOGRAPHY.

Quite a contrast is presented by the topography of the country. Along the southern and eastern fringes around Millaa Millaa, Butcher's Creek and Topaz, the land is generally hilly and broken by many

streams (Plates 2 and 3). Such land is unsuitable for cultivation because of the frequency of heavy storms. This area is the highest and coldest, the altitude ranging from 2,500 ft. to 3,000 ft. It is almost exclusively dairying land.

Proceeding northward, a gradual change occurs until Malanda is reached. There is an area of undulating land around Malanda (Plate 4) and appreciable areas can be cultivated. Streams are not so numerous and the altitude is 2,200-2,400 ft. This is primarily a dairy-farming area with a little maize-growing on the northern fringe.



Plate 2.

A Dairy Farm in the Millaa Millaa District.



Plate 3.

The Herd and Buildings on a Millaa Millaa Dairy Farm.

Another type of land is seen in the area between Atherton, Kulara, Kairi and Tolga, where the country has a very gentle slope (Plate 5). The elevation remains in the 2,000-2,400 ft. range. This is a concentrated maize-growing area.



Plate 4.

A Dairy Farm in the Malanda District.



Plate 5.

Maize Stubble on a Kairi District Farm. The stubble is being cleaned up by dairy cows.

Because of the loose nature of the soil and the heavy storms which are prevalent during early summer, the cropping of slopes above 6% requires great care if soil erosion is to be avoided. Land with a slope greater than 10% should not be ploughed and cropped, since bare soil is in danger of being eroded. In general, therefore, it can be said that the topography of the land prevents crop cultivation in the Millaa Millaa-Topaz area, permits a limited amount in the Malanda-Yungaburra-Peeramon area, and is favourable for intensive cultivation in the Atherton-Tolga-Kairi triangle. The area between the Barron River on the east and the Great Dividing Range on the west contains the bulk of the most suitable agricultural land within the two shires.

A feature of the area is the splendid network of streams on the southern end. There is a shortage of small permanent streams on the northern fringe, although this portion is served by the Barron River.

There are two main river systems and one smaller one. The Barron River rises in the Herberton ranges and flows northwards until it turns abruptly in an easterly direction as it leaves the Tableland. A comparatively small area in the Topaz district is drained by the Russell River. The central and southern portions are drained by the Ithaca, Beatrice and North Beatrice Rivers, Dirran Creek, and other small, permanently flowing streams which run into the North Johnstone.

CLIMATE.

Temperature.

The tropical situation is influenced by the elevation and the result is a climate without extremes of heat and cold. Temperature readings are available for Atherton only, and the average minimum and maximum readings for the past four years are given in Plate 6. This shows that the average maximum of 82.5° is reached in December/January and that for six months of the year the maximum exceeds 80°. A temperature of 100° is rarely recorded. The average minimum temperature in the coldest month (August) is 50°.

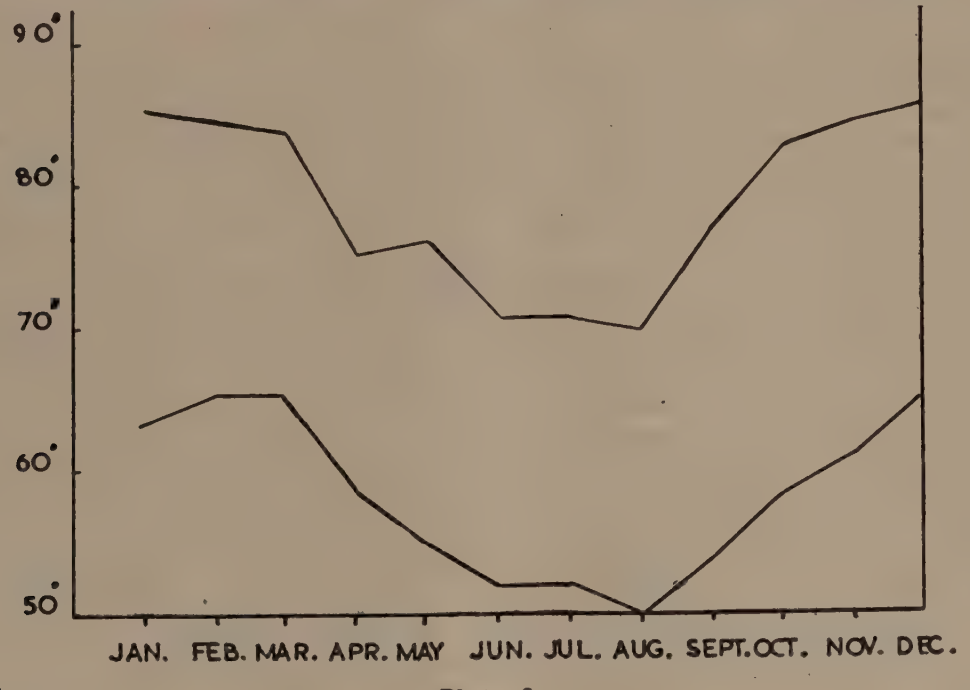


Plate 6.

Graph Showing the Average Maximum and Minimum Monthly Temperatures for Atherton, 1947-50.

Frosts are occasionally recorded in lowlying spots in the Atherton area. Southward and eastward from Atherton, frosts are more common, while the maximum temperatures also tend to be lower. Heat comparable to that of the adjacent coast is seldom experienced, and even in midsummer the night temperatures are not uncomfortably high.

Rainfall.

Rainfall data for the years 1935-1950 are summarised in Table 1.

TABLE I.

RAINFALL DATA FOR THREE ATHERTON TABLELAND CENTRES.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly
ATHERTON.													
Aver. Rain	964	1,545	1,267	450	256	218	154	100	104	98	328	659	6,105
Max. Rain	1,941	2,956	2,332	1,328	507	470	344	499	248	257	787	2,389	8,982
Min Rain	433	365	131	79	11	25	22	0	0	8	37	89	3,896
Av. Wet Days	14	17	16	14	12	10	10	6	6	5	7	10	
Max. Wet Days	22	21	22	24	20	17	16	16	11	8	11	21	
Min. Wet Days	5	13	5	5	1	3	1	0	0	1	4	4	
MILLAA MILLAA.													
Aver. Rain	1,408	2,002	2,208	1,121	716	575	480	341	309	252	454	738	10,597
Max. Rain	2,465	3,434	4,288	2,723	1,413	1,173	946	1,154	735	932	1,081	2,967	15,446
Min. Rain	225	817	506	165	78	107	142	4	0	0	135	47	6,744
Av. Wet Days	15	17	19	18	16	14	12	9	7	7	9	9	
Max. Wet Days	21	23	27	30	29	26	24	18	13	14	14	18	
Min. Wet Days	4	9	5	5	3	4	7	1	0	0	3	3	
MALANDA.													
Aver. Rain	971	1,589	1,425	635	317	284	192	171	131	112	309	624	7,347
Max. Rain	1,862	2,394	2,952	1,576	607	615	383	563	257	257	769	2,527	9,613
Min. Rain	222	364	257	188	33	66	18	11	3	14	60	86	4,479
Av. Wet Days	17	20	19	18	15	14	13	10	9	8	10	13	
Max. Wet Days	23	28	27	28	26	23	23	22	21	16	16	23	
Min. Wet Days	9	11	3	6	2	4	4	0	1	2	4	5	

The average annual rainfall varies from 40 inches on the northern fringe to 120 inches in the south-east. Atherton has an average of 62 inches, the range over the past 16 years being from 39 inches to 90 inches. The average for Malanda is 67 inches, and the range 44 inches to 96 inches. Millaa Millaa has an average of 108 inches.

The rainfall occurs mainly in the summer and follows a pattern. Storm rains usually commence in late November or early December and continue into January. Monsoonal rains follow during February and March and provide over one-third of the year's total. The rainfall is lighter in April, but the greatest number of wet days occurs during that month. April is the dividing line between the "wet season" and what is known locally as the "drizzle," which extends through May into June and is characterised by a large number of wet days without much effective rain. The "drizzle" is heaviest and most prolonged on the south-eastern fringe and gradually tapers off towards the north.

Sporadic rain occurs during the period July to November, which represents the "dry season." Rainless months recorded on the Tableland include August and September at Atherton, August at Malanda, and September and October at Millaa Millaa.

Atherton usually experiences earlier storms, but the wet season rainfall is lighter and terminates earlier than in the Millaa Millaa area. The average number of wet days per annum during recent years was 129 at Atherton (range 81 to 157) and 165 at Malanda (range 99 to 220).

Despite the moderate to high average annual rainfalls experienced, there is often a shortage of soil moisture from July to November.

Humidity.

Humidity gradually rises during November with the approach of the storms and continues to be high until the end of the "drizzle," usually in June. There is then a sharp drop in humidity, and crisp, clear mornings followed by bright sunny days are the general rule during the winter months.

SOILS.

The predominant soil type is a red volcanic clay loam of basaltic origin; there are smaller areas of lighter-coloured soil derived from granites and schists. There are sharp differences in soil fertility even within a small area, and it is not uncommon to find two or three different soil types within the boundaries of one holding.

The soils can be roughly divided into "scrub" and "forest" soils according to the nature of the original vegetation. "Scrub" refers to the dense growth of tropical softwoods and hardwoods, accompanied by smaller shrubs and vines. "Forest" is characterised by hardwoods without dense undergrowth and with some native grasses in evidence.

All scrub soils are red basaltic clay loams, of great depth, quite porous and originally very fertile. The original fertility is quickly lost unless proper measures of pasture management are undertaken. Scrub soils occur in the higher rainfall areas of 50 inches and over.

Forest soils vary from light red to sandy and are generally located in the drier areas and on the fringe of the shires—for example, at Danbulla, Kulara and Barrine. These soils are not so fertile as scrub soils but generally have a more retentive subsoil and will hold moisture for a longer period.

VEGETATION.

Some of the finest cabinet timbers in Australia—including red cedar, black walnut and maple—were to be found in the original scrub, but most of these have now been removed.

The main forest species comprise bloodwood, yellow stringybark, grey box and ironbark and form an open woodland. Kangaroo grass (*Themeda australis*), forest blue grass (*Bothriochloa intermedia*), Queensland blue grass (*Dichanthium sericeum*), spear grasses (species of *Stipa* and *Heteropogon*), love grasses (species of *Eragrostis*), three awned spear grasses (species of *Aristida*), and wild sorghum (*Sorghum plumosum*) are the main native grasses. Three varieties of lantana are to be found under natural conditions, usually along creek banks.

Blady grass (*Imperata cylindrica* var. *major*) also occupies a portion of the forest country under natural conditions, together with bracken fern (*Pteridium aquilinum*). The native grasses provide bulky grazing during the wet season but usually dry out to become quite brittle during late winter and spring.

Following the removal of the natural vegetation, various grasses have been established. Kikuyu grass predominates in the wetter areas to the south and east, although there are some areas of paspalum and some of molasses grass. White clover has been successfully incorporated in the pasture on a few farms. Paspalum is the main pasture species in the Malanda district and is the sole constituent of the pasture on a large portion of this area. Further north, in the drier areas around Kairi, and on forest soils, paspalum gives way to Rhodes grass and some of the native species. A little green panic (*Panicum maximum* var. *trichoglume*) has been sown; this grass appears to be both more palatable and more nutritious than Rhodes grass.

TYPES OF DAIRYING.

With the exception of one or two small dairies which supply wholemilk to towns, dairying is of two types. In one type, cream only is supplied to a butter factory and the skim-milk is utilised on the farm as a feed for calves and pigs. In the second type, both wholemilk and cream are supplied, the quantities varying according to the demand for wholemilk. Normally, during the flush of the season wholemilk is taken in the morning only on two or three days a week. As the supply decreases, the milk is taken more frequently until it is being taken on six mornings a week. Since farmers supplying wholemilk and cream usually rear their heifer calves and run pigs, some supplementary feeding is necessary for these stock. Difficulties in providing feed for calves and pigs are sometimes experienced when the farmer cannot accurately forecast the amount of skim-milk he will have available. For this reason, some men prefer to supply cream and feed more pigs at less cost.

Some dairymen on the Tableland supply wholemilk to a milk products company in Cairns and on occasions this company is willing to take the whole day's supply provided it can be picked up in one trip. To meet this demand, these suppliers are installing refrigeration plants in which the night's milk is held prior to delivery next morning. Should this trend develop, these farmers will probably cease to raise pigs and use calf meals and limited wholemilk feeding in order to raise their heifers for herd replacements.

Apart from stud cattle, very few male calves are reared on the farms. Progressive dairymen have found that pig-raising is more profitable and does not involve the use of so much land. Many good-framed A.I.S. calves are sold weekly for slaughter at a price usually between £1 10s. and £2. Where farmers who supply cream only have a paddock which cannot be used for dairy cows, a profitable sideline can be built up by purchasing these week-old calves.

No cheese is manufactured in North Queensland.

SIDELINES ASSOCIATED WITH DAIRYING.

Pig-raising is the almost universal sideline to dairying and the industry is well developed. There is a co-operative bacon factory situated at Mareeba, and the Northern Pig Marketing Board controls the marketing of all pigs in the area. In the shires of Atherton and Eacham, two factors have had a retarding influence on expansion since the end of the war. One is the increasing quantities of wholemilk which are being marketed; the other is the very high price of maize. During the year 1950-51, a total of 13,985 pigs was purchased by the Marketing Board, and of these 8,154 went to the bacon factory. It can be said that at present prices a well-managed piggery is a profitable sideline. The main breeds used are Large White, Berkshire and crosses between the two. It is likely that pasture will play an increasingly important part in providing feed for the pig-raising industry.

Maize-growing is an important sideline in the area which embraces Atherton, Tolga, Kairi, Danbulla, East Barron and portion of Upper Barron. Many holdings in this area are purely maize farms. Dairying as a sideline to maize-growing is conducted on some farms, and as the topography and rainfall become limiting factors to maize-growing, maize becomes a sideline to dairying.

More maize farmers are turning to dairying as a means of combating the bad effects of monoculture. Without the use of green manures and fertilizers, yields are falling, and farmers are finding that by sowing a pasture or lucerne (where suitable) and running a few dairy cows to utilise this growth they are maintaining their income without depleting soil fertility. With proper utilisation of animal manure it may be expected that soil fertility will gradually be built up and the farmer assured of a reasonably good living. He is also in a far more secure position to meet adverse conditions, such as falling prices and unfavourable seasons.

In the area around Rocky Creek and Carbeen, and in other small areas, peanut-growing is a very useful sideline. Being a legume, the peanut has the advantage of increasing the nitrogen content of the soil. The tops may be utilised as roughage for the dairy herd.

Vegetable-growing is becoming an increasingly popular sideline where irrigation can be practised. At certain times of the year there is a good demand from coastal towns for beans, peas, potatoes and other vegetables. In the drier part of the Tableland where irrigation and labour are available there is room for expansion of vegetable production. Flower production for Cairns and Innisfail is another avenue capable of being exploited.

In areas which roughly correspond with the maize areas there are possibilities for lucerne-growing on a commercial scale, but irrigation and suitable machinery are essential. The small quantity of locally-grown lucerne hay which is available is inadequate. Allowing for some losses on account of bad haymaking weather in summer, an acre of lucerne should yield four tons per year.

Poultry provide another avenue of income which is not inconsiderable. Eggs not required for local trade on the Tableland can be sold in Cairns.

SIZE OF FARM.

The information given in Table 2 has been compiled from returns made by farmers.

TABLE 2.

FARM SIZE AND CARRYING CAPACITY.

District.	Total Area.	Average Area.	No. of Farms.	Total No. of Animals.	Average No. of Animals.	Acres Per Animal.
	acres.	acres.				
Atherton	27,671	208	133	6,574	49	4·2
Malanda	45,433	228	199	13,809	69	3·3
Millaa Millaa	30,081	228	132	9,357	71	3·3
Yungaburra	17,307	219	79	5,088	64	3·4
Total or Average	120,492	222	543	34,828	64	3·5

When the Atherton returns are subdivided into purely dairy farms and dairying plus maize farms, the comparison is as follows:—

—	No. of Farms.	Area (acres).	Average Area.	Average No. of Animals.	Acres per Animal.
Dairying only	83	16,629	200	51	3·9
Dairying + Maize	50	11,042	221	47	4·7

Table 2 shows that the average farm size in the Yungaburra district is less than that in the Millaa Millaa district. However, many properties in the latter district still carry some areas of scrub, which means that the effective acreage is considerably less than that shown. Most of the properties in the Yungaburra area are cleared and the whole area is available for grazing. It is generally considered that land in the Millaa Millaa area has a higher carrying capacity than land in the Yungaburra district.

Stock numbers embrace cattle of all ages, plus horses. The average milking herd comprises roughly two-thirds of the total number of animals.

FARM PRODUCTION.

The output of dairy produce per farm varies greatly and depends on many factors, such as fertility of the soil, quality of the stock, ability of the farmer, and amount and incidence of rainfall. Production figures for four individual farms are as follows:—

No. 1.

Millaa Millaa area. Paspalum and kikuyu pastures. No cultivation, but limited feeding of concentrates.
Area—246 acres.
Total milking herd—58.
Production—5,509 lb. commercial butter and 10,617 gallons wholemilk.

No. 2.

Malanda area. Mainly paspalum pasture. Herd provided with some oat grazing and limited concentrate feeding.
Area—360 acres.
Total milking herd—61.
Production—5,982 lb. commercial butter and 11,511 gallons wholemilk.

No. 3.

Millaa Millaa. Paspalum, kikuyu and clover pasture; practically no supplementary feeding.

Area—210 acres.

Total milking herd—56.

Production—8,047 lb. commercial butter and 13,150 gallons wholemilk.

No. 4.

Malanda area. Paspalum and molasses grass. Cultivation areas being developed. Limited hand-feeding.

Area—236 acres.

Total milking herd—53.

Production—2,672 lb. commercial butter and 7,345 gallons wholemilk.

The first three farms are above average, while the fourth is in the process of being developed in respect of both the herd and the farm and is probably below average.

While there are many herds which yield much more heavily, the average annual production of all cows milked is about 160 lb. commercial butter. Over the total farm acreage the average butter production would be about 35 lb. per acre. The best farms can double that figure, while those at the bottom of the list are scarcely worth the title of dairy farm.

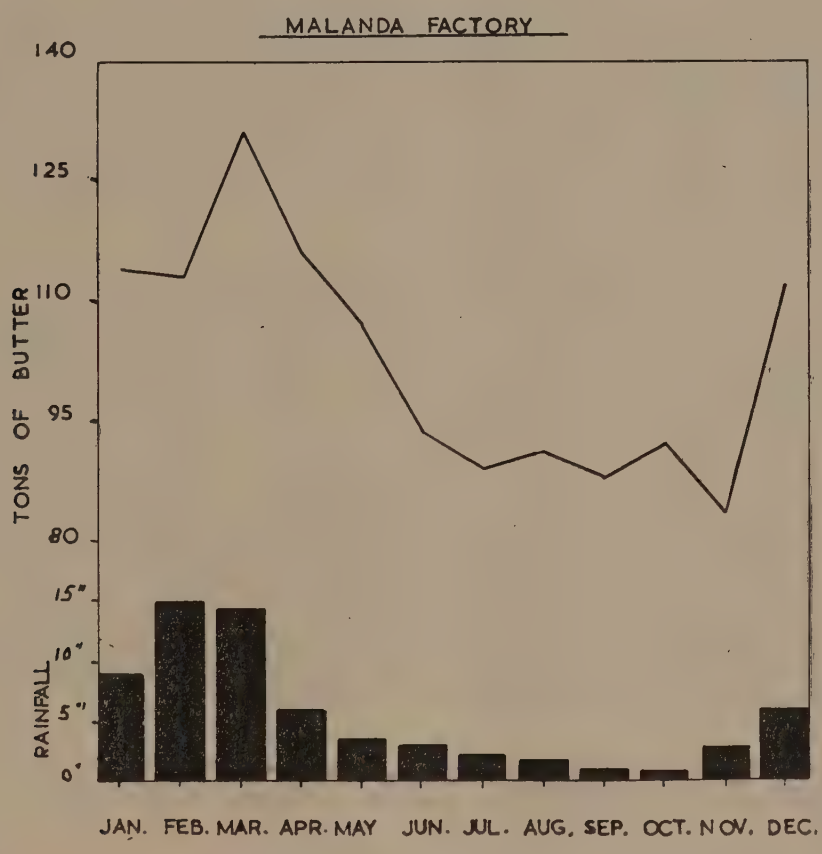


Plate 11.

Graph Showing the Relationship Between Rainfall and Butter Production at the Malanda Factory.

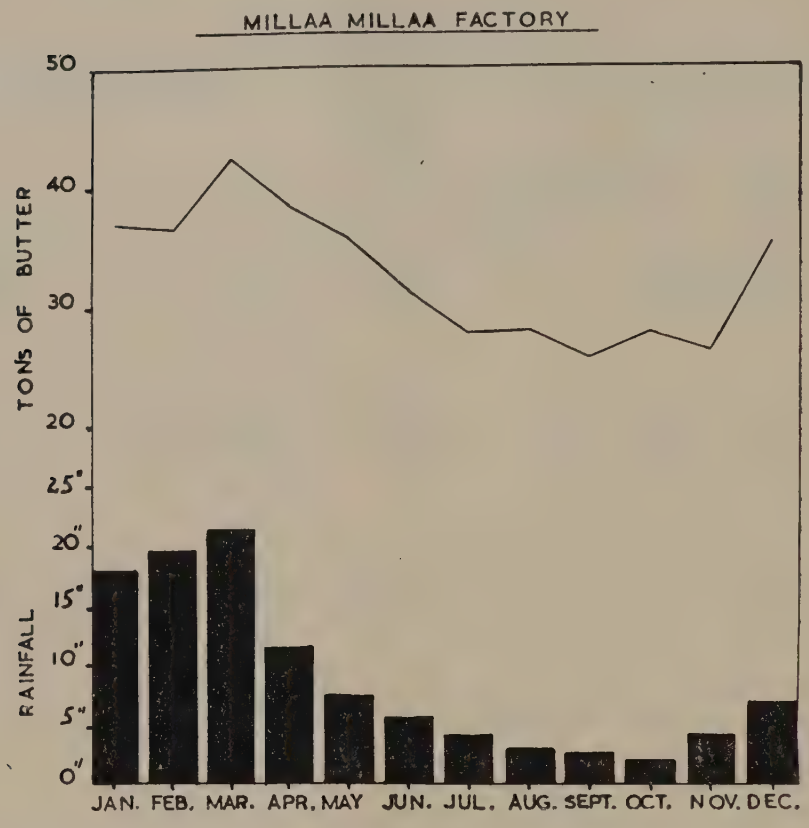


Plate 12.

Graph Showing the Relationship Between Rainfall and Butter Production at the Millaa Millaa Factory.

A good idea of the seasonal production can be gained from the graphs of monthly production of the two factories (Plates 11 and 12). In the drier northern end of the Eacham shire, production during the months of August to October is very low unless extensive hand-feeding is practised. This is because of the low rainfall and the low nutritive value of the pastures at that time. Production from farms in the Millaa Millaa, Topaz and Glen Allyn areas is not so variable; it is normally at its lowest in November and early December. The seasonal production is very closely allied to rainfall.

BREEDS OF CATTLE.

A.I.S. and Jersey are the two most favoured breeds; the choice of breed is largely determined by the nature of the product which is supplied—that is, cream or wholemilk. For example, in the Danbulla district, which supplies cream only, Jerseys predominate, while wholemilk suppliers close to the Malanda factory run mainly A.I.S. Guernseys also are important, particularly in the Millaa Millaa district, and are tending to become more popular. They find favour with those people who like a Channel Islands breed but consider the Jersey to be a little small for their conditions. An occasional Ayrshire is used, but there are no Ayrshire herds, though one Ayrshire stud is in the process of being established. Friesians are not represented on the Tableland.

The approximate numbers of the main breeds are:—

A.I.S.	18,000
Jersey	15,000
Guernsey	2,000

HUSBANDRY METHODS.

Herd Management.

The general practice is to have cows calving in the second half of the year. This enables advantage to be taken of the lush pastures which are usually evident from December to June. An analysis of data from group herd recording from 1948 to 1950 made by the Department's Herd Recording Section shows that seven-eighths of the total number of cows freshened in the period July to January. The average yield of these cows was 166 lb. butterfat. This is in marked contrast with the yield of 107 lb. butterfat which was made by the cows which calved from February to June. While these figures give a general picture of the best calving months, it does not necessarily follow that good production cannot be obtained all the year round. Production is largely a matter of what feed is available to the cow. Except on highly developed farms of good soil in very favourable areas, the cost of production during the winter months is considerably greater than during the summer because of the necessity for supplementary feeding. However, considering the all-the-year-round demand for milk and the increased winter price which operates from April 1 each year, added to the fact that some skim-milk is available for pig-feeding, some farmers believe that it is a sound policy to calve cows all the year round.

One other factor which operates against seasonal calving is the lack of a bull paddock on many farms. It is highly desirable that the bull be contained in a special paddock and the cows taken to him for service. By this means a good check can be kept on breeding records, health of the herd, and season of calving. The bull will also work more effectively and is not so likely to be injured in fights with other bulls.

Farmers in herd recording units have the opportunity of proving their sires by recording their daughters. The main problem here is to keep a bull until such time as the production of a sufficient number of daughters becomes known without recourse to inbreeding. Those with herds large enough to warrant the use of two bulls can avoid close breeding by using one bull on the daughters of the other. Another device is to use a bull for one season, then lease it to another farmer; sometimes bulls are exchanged between farmers. On other occasions a bull may be sold with the option of re-purchase within a specified time, though some men do not like to bring a bull back into a herd from elsewhere for fear of introducing disease.

Husbandry methods adopted for the purpose of controlling diseases and pests include vaccination of calves with strain 19 vaccine, control of ticks and buffalo fly by the use of insecticides, routine drenching of calves with phenothiazine, and the testing of milk-supply herds for tuberculosis. Footrot, milk fever and calving paralysis are by no means uncommon, and a temporary sterility often shows up in herds.

Dehorning is not practised to any great extent, although those farmers with dehorned herds consider the operation worthwhile.

"Steaming-up" of cows prior to calving is not generally in vogue, but many farmers aim to have their cows in a handy paddock as the day of calving approaches.

Nutrition of the Herd.

Pasture is the basis of feeding, the main pasture plants being paspalum and kikuyu grasses, followed by molasses grass (Plate 7), Rhodes grass (Plate 8) and common Guinea grass. Lack of a pasture legume is a severe handicap, though white clover grows fairly well in isolated areas. Some farmers have shown that subdivision into smaller areas, rotational grazing, frequent harrowing of pastures to spread the manure, distribution of manure from the bails, and the use of the mowing machine are valuable aids in pasture improvement.

In many areas on the northern end of the Tableland, pastures deteriorate very quickly from July to November and in this period it is important that some other form of feed be available. Silage is the most suitable. Though the amount of labour involved in



Plate 7.

Molasses Grass on a Dairy Farm in the Millaa Millaa District. This stand was established on a scrub burn eight years previously and has been maintained in good condition by careful management.



Plate 8.

Dairy Cows Leaving a Mixed Lucerne and Rhodes Grass Pasture on a Kairi District Property.

making and feeding this material is a handicap, there are now a couple of mechanical harvesters available in the district. Most silos in the district are of the underground circular type with a concrete collar to prevent the top from falling in.

Crops which can be grown for silage include maize, sorghum, millets and Sudan grass. The incorporation of a legume such as cowpea or Mauritius bean improves the feeding value of the silage. If sown with the main crop, these legumes render harvesting rather difficult, and for this reason separate plantings may be desirable. It is probable that some lucerne silage will be made as the area under lucerne expands.

A popular method of providing roughage is to plant a paddock of cowcane or elephant grass. The former stands for long periods in the paddock, and although it becomes fibrous it still supplies a large quantity of roughage. A good crop of cowcane should yield about 30 tons of green feed per acre. Cowcane is best fed chaffed to the cows in stalls.

Elephant grass has a higher feeding value than cowcane but becomes very fibrous if allowed to grow too tall. It gives a good bulk of feed and comes away quickly after cutting provided it receives plenty of farmyard manure. Like cowcane, it should be cut with a cane knife and put through a chaffcutter before being fed to stock; otherwise wastage occurs.

In most years a small area of cowcane and elephant grass would supply sufficient roughage to carry the stock over a dry season. A pit of silage should also be retained as an insurance against drought.

Peanut straw is becoming available in increasing quantities and is eagerly sought by dairymen who have no conserved fodder. The quality varies considerably according to the amount of leaf retained on the plant and the number of nuts which have escaped the threshing machine. A hammer-mill is sometimes used to convert the straw into a meal, which is quite palatable. A little cowpea and other leguminous straw is also available from those farms in the north which produce green manure seeds.

High grain prices over the last few years have made farmers reluctant to feed grain to stock, but on some mixed farms the whole cob is put through a grinder to produce a cob and corn meal. This meal is rather low in protein, and best results are usually obtained by adding meatmeal to give a concentrate mixture of 18-20% protein.

Molasses has usually been readily available and is fed almost universally, often all the year round. Farmers claim that the feeding of molasses brings the cows to the bails at milking time, keeps them contented in the bails and has a desirable medicinal effect.

Farmers who are short of roughage in winter and spring sometimes obtain peanut hulls from the Peanut Marketing Board's depot and feed them with molasses; this feed has a low value.

A small quantity of wet brewers' grains is transported from the brewery at Cairns; it is a useful feed, though it can be stored for only a few days.

A phosphorus deficiency exists in some herds, and many farmers aim to meet the mineral needs of their stock by providing a lick of salt and bonemeal. No definite cases of deficiencies of other minerals have been found in milking cows.

Breeding Policies.

Breeding policies are of two classes—stud-breeding and commercial breeding. Stud-breeders generally are adopting a policy of either out-crossing or wide line-breeding. Where more than one herd sire is maintained, it is not unusual to find that the sires in use are from different studs and unrelated. The more progressive men are beginning to recognise and build up cow families, and it is expected that they will in time breed their own sires to a much greater extent than at present.

The commercial herds generally are being graded-up by the use of purebred bulls. Less cross-breeding is in evidence now than has been the case in the past. Guernseys have been crossed with Jerseys in order to build up the frame of the latter, but this cross appears to be losing popularity. Some Guernsey x A.I.S. crossing has been done and the first-cross appears to be above the average as a producer. The second generation is often disappointing and generally the policy of grading-up is accepted and practised. A number of commercial herds are headed by sires purchased in other parts of Queensland, but local breeders have supplied the bulk of the sires.

Calf-raising Methods.

Milk and pasture provide the basic foods for calves. The quantity and type of milk depend on the particular type of dairying.

Farmers supplying cream only usually allow calves some whole-milk up to the age of three weeks to one month and then feed on all skim-milk. Some allow the calves access to molasses and others add watered molasses to the milk. Grazing areas are sometimes too small for the number of calves which are being reared, with the result that calves often suffer from internal parasites. In other instances the calves have the run of the farm after they reach the age of two months. The provision of proper grazing areas for calves to permit grazing on the rotational system is worthy of more widespread adoption.



Plate 9.
A Well-shaded Calf Paddock in the Moreqatta District.

Wholemilk suppliers usually send only the morning's milk and separate the afternoon's supply. Some retain sufficient of the skim-milk from the afternoon to feed the calves next morning. Others feed their calves on skim-milk in the afternoon only when no separating is done in the morning. In all cases, wholemilk suppliers tend to give calves some wholemilk up to the age of two months, by which time they have had a good start. Calf meals are not used to a great extent, but are likely to become more popular.

Care of calves after weaning is often unsatisfactory and the period from weaning to the advent of the summer storms is a critical one. Too often calves which have consumed gallons of valuable wholemilk are put away in a back paddock after weaning and fail to maintain their growth rate. This results either in undersized cows (if they freshen at the normal age of 2-2¼ years) or else a delay in producing the first calf. This could be obviated in most cases by feed of better quality or a little supplementary feed at the critical age.

Most farmers retain only sufficient heifer calves for their own herd replacement and the remainder are sold as vealers at a couple of weeks of age. A recent check has shown that heifer calves comprise 28% of the total calves sold for veal. Stud-breeders usually rear all heifer calves, for which there is a ready sale.

Very few farmers adopt the practice of dehorning calves despite its obvious advantages.

WEEDS.

Because of the favourable climatic and soil conditions, many aggressive weeds occur on farms in the district.

The main weeds of pastures are lantana, wild tree tobacco, bracken fern, wild raspberry, inkweed, arsenic bush, blady grass, mat grasses, sour grass and Parramatta grass.

Cultivation weeds include wild hop, stinking roger, crowfoot grass, couch grass, star burr, purple top, blue top, cobbler's pegs, wild radish, wild turnip and Mexican poppy. Land which is taken out of cultivation and put down to pasture often becomes infested with crowfoot grass, Mossman burr, blue top, stinking roger, common sida, wild radish, wild turnip and Mexican poppy.

Pastures newly sown on burnt scrub land usually have to compete with lantana, wild tree tobacco, wild raspberry, inkweed and arsenic bush, and control measures should be adopted. Established pastures become weed-infested mainly because of declining soil fertility and overgrazing. Mat and sour grasses are spreading in the Millaa Millaa area in particular, while in the northern portion blady grass and Parramatta grass are common pasture weeds.

Wild turnip and wild radish can be troublesome in winter-growing grazing crops such as wheat, oats and barley (which are grown to a slight extent in the district), not only as competitors of the crop but also as milk and cream tainters. On cultivated farms, stinking roger may cause a weed taint which is difficult to remove.

The main poisonous plants encountered in the area are bracken fern, lantana, balloon cotton bush, red-headed cotton bush, poison peach, zamia palm, arsenic bush and Johnson grass. Young cattle (often calves on the bucket), hungry stock and stock new to a property are most likely to suffer from plant poisoning.

FARM WATER SUPPLY.

At the southern end of the area, water from the network of streams is the source of the farm supply and is obtained by hydraulic ram where the layout is suitable. Where a ram cannot be operated efficiently, recourse is made to pumping. Pumps powered by a motor engine are the most numerous, followed by windmills and finally electrically-driven units.

In the Tolga-Kairi area to the north, suitable streams are not available to many farms and the necessary water has to be obtained by means of a bore and windmill. Very little water is available at depths less than 100 feet and often it is necessary to go much deeper in order to get a good supply.

STUD-BREEDING ACTIVITIES.

During the war, registrations of stud cattle were discontinued by some stud-breeders and in some instances men are members of a breed society without actually being engaged in stud-breeding. There are 27 stud-breeders still operating, most of them on a restricted scale. There are 12 A.I.S., 11 Jersey, three Guernsey and one Ayrshire studs. There is a fair demand for sires from local dairymen, but few stud-breeders are prepared to rear bull calves without having definite orders for them.



Plate 10.

Cows Lined Up for Judging at the Millaa Millaa Show.

Every active stud is headed by a bull from southern Queensland or New South Wales, and blood-lines of well-known families are found in all breeds. In many cases neither effort nor money has been spared in obtaining high-class cattle, and there are now some very good stud cattle in the district.

Stud-breeding policy generally is to breed from one line of cattle with an occasional outcross. No intensive line-breeding is being deliberately followed yet.

HERD RECORDING UNITS.

Four herd recording units of 18-20 herds each operated in the district during 1952 under the Department's herd recording scheme. The average production of herds in three units for the year ended September 30, 1951, was as follows:—

Unit.	Average Milk Yield.	Average Butterfat Test.	Average Butterfat Yield.	Length of Lactation Period.
	lb.	%	lb.	days
Millaa Millaa	4,112	4·5	186	226
Malanda No. 1	4,493	4·3	195	222
Malanda No. 2	5,279	3·9	208	211

PRESENT TRENDS.

During the past few years there has been a reduction in the number of dairymen in the area. However, in some cases two farms have been amalgamated, with the result that loss in production has not been marked. There are some dairying properties which are now used for grazing beef cattle, but it is considered unlikely that this trend will continue. In fact, it would not be surprising if dairying were resumed on most of these areas.

There is an increasing demand for wholemilk, and with the improved transport facilities which are being provided it is likely that considerable expansion of wholemilk production will occur. The installation of dairy refrigerators on farms, which is steadily proceeding, will enable more farmers to send their total supply as wholemilk.

Increasing thought is being given to fodder conservation in order to maintain production over the period of the year when pastures are generally inadequate. The irrigation of pastures is one avenue which may be expanded where conditions are favourable. Lucerne is being grown by more farmers each season.

There is little doubt that the area generally is well suited to dairying, but it has to be recognised that more fodder conservation is essential if the industry and the district are to continue in a prosperous condition.

The areas suitable for dairying are fairly closely settled and there is not much scope for further subdivision of holdings. Much of the area is held in freehold tenure; the remainder, apart from State forests, is held under various forms of Crown leases.

PESTS AND DISEASES HANDBOOK.

The second edition of Volume III of the "Queensland Agricultural and Pastoral Handbook" is now available from the Department of Agriculture and Stock.

The description and control of pests and diseases, which affect most of the farm and orchard crops grown in Queensland, are set out. There is also a chapter on insecticides and fungicides and one on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for fifteen shillings, post free in the British Commonwealth.

Cottage Cheese.

Prepared by Officers of the Division of Dairying.

EARLY attempts to manufacture cottage cheese in Queensland were along lines laid down by standard text books on the subject from overseas countries, but the resultant product was unsuitable for the trade. This necessitated lengthy experiments before a suitable article was produced, and a number of wide variations from the usual methods were brought forward.

Experimental work was originally carried out at the Pittsworth Cheese Factory by Mr. R. Duncan, and to him goes the credit of producing an article suitable for the particular trade for which it was manufactured. It was found that the process of manufacture could vary from day to day, and to extremes unknown in normal cheddar cheese manufacture. The individual skill of the operator is of prime importance, and he must know the exact procedure to adopt to produce the type of cheese required. This knowledge can only be gained from experience and from a careful study of the effects of varying temperatures and acidities on the body, texture, and flavour of the cheese.

The following is an account of the process of cottage cheesemaking at present being employed in Queensland.

COTTAGE CHEESE AS MADE IN QUEENSLAND.

Cottage cheese is made from pasteurised skim-milk. The usual practice is to pasteurise the wholemilk at a temperature of 156-160°F. as it is received (high temperature-short time (H.T.S.T.) pasteurisation) and then cool to 98-100°F. prior to separation. The separated milk is run straight into the making vat at a temperature of 94-96°F., at which it is maintained during the ripening period.

Ripening.

The percentage of starter culture required depends on the initial acidity of the skim-milk, the ripening temperatures used, and the time of the year; it varies from 5% to 15%. The starter is added to the vat; the milk is stirred for a few minutes, then covered and allowed to ripen. In from 4 to 6 hours from the time the starter is added the milk should have coagulated and show an acidity of from ·75% to ·85%. If the temperature has not dropped too low, the curd should be ready to work at this stage. At some times of the year and under certain weather conditions it is necessary to use a higher temperature during ripening in order to obtain the desired firmness of the curd at the time of coagulation.

Cutting or Breaking the Curd.

The usual practice in Queensland is to break up the coagulum by hand, as it is held that the loss of curd in the whey is too great when the curd is cut with ordinary curd knives. However, if knives are used with the blades or wires set $\frac{3}{4}$ in. apart (twice the normal distance apart), a much more even size of curd particle is obtained than when hand-breaking is employed, and losses are not great. The curd is gently stirred by hand after breaking or cutting, as mechanical agitators are too severe and cause the curd to become too firm and harsh, as well as increasing the loss of curd in the whey.

Cooking.

The batch is slowly heated (or cooked) at the rate of ·5°F. per minute, increasing the temperature to 104°F. or higher. The temperature and period of time depend on: (*a*) the rate of acid development during ripening; (*b*) the acidity at the time of breaking; and (*c*) the body and texture of the curd. The faster the rate of acid development and the higher the acidity at the time of breaking, the higher the temperature employed and the quicker it is raised. If the body of the curd is inclined to be weak, then a longer cooking time will be employed. The body and texture of the cheese must be closely checked at this stage, the best method for doing this being to place a handful of curd in cold water, this bringing about rapid cooling and giving an indication of what the resultant cheese will be like. If the batch is ready to whey off, the curd will be firm without being tough and will crumble readily in the hands, and the curd particles will not have soft centres.

Wheying-off.

The whole of the curd is drawn back to the top end of the vat and allowed to settle. This can best be done with curd rakes and draining boards, and care must be taken not to break up the curd lumps and so increase losses in the whey. As wheying-off is progressing, drains are made in the centre and sides of the curd to speed up the process. The whey at this stage should be clear and show an acidity of from ·60% to ·70%, depending on the acidity of the bulk at the time of breaking of the curd. The curd is then allowed to drain for 5-10 minutes until most of the whey has escaped.

Cooling.

When the curd has reached the desired stage of firmness at wheying-off, the temperature of the curd is still within a few degrees of the cooking temperature. If the curd is allowed to remain at this temperature for any great length of time it will result in too much firming-up of the cheese. For this reason, cooling should be carried out as soon as possible after the bulk of the whey has escaped from the curd particles. The cheese is spread evenly over the bottom of the vat and cold water allowed to run through the vat. After a few minutes, the draining tap is shut and cold water added to the vat until the curd is completely covered. The curd is left in this water for 10-20 minutes, after which the water is drained off. The temperature of the water should be as low as possible.

Salting.

When draining is completed the cheese is salted at the rate of 10-20 oz. per 100 lb. of cheese. A soft curd requires more salt than a firm curd, while the tastes of consumers have also to be considered. The salt is spread evenly over the cheese, the cheese being then packed into suitable containers for transport to the consumers. It is advisable to hold the containers (usually cans) in a refrigerated room until the cheese is consumed, as low temperatures retard bacterial development and deterioration of quality.

Yield.

The yield of cheese is usually 130-140 lb. per 100 gallons of skim-milk treated.

General Remarks.

Cottage cheese has a higher moisture content than ordinary hard types of cheese, and for this reason even more care than usual must be taken to see that all equipment used is thoroughly cleaned and sterilized.

In addition to this, the following rules must be observed:—

(1) Carefully control the H.T.S.T. pasteurising temperature to the limits of 156-160°F. With all of the equipment in a clean and sterile condition, the destruction of bacteria at this temperature will be quite satisfactory, while temperatures in excess of 160°F. are likely to cause difficulty in obtaining a firm curd during manufacture.

(2) It is imperative to use a pure starter culture to give clean acid development. A contaminated starter culture will result in unclean and "off" flavours in the resultant product.

(3) The quality of the water used for cooling the curd must be beyond question. Contaminated water supplies may cause offensive flavours in the cheese.

COMMON DEFECTS IN COTTAGE CHEESE.

(1) *Weak and Mushy Body.*—This is due to too high a moisture content in the cottage cheese brought about by the following:—(*a*) cooking at too low a temperature; (*b*) cooking too rapidly after cutting or breaking the curd; this hardens the outsides of the curd particles and seals the moisture in.

(2) *Dry, Harsh Body.*—The following are the chief causes of this defect:—(*a*) too high a cooking temperature, which results in too much moisture being driven out of the curd and the curd being firmed-up too much; (*b*) too long a cooking period, which gives the same result as in (*a*); (*c*) excessive, or too vigorous, stirring of the curd.

(3) *Sour, Overacid Flavour.*—This is usually allied with weak and mushy body and is exaggerated by the following:—(*a*) too rapid ripening (too much starter) or too high an acidity at breaking or cutting; (*b*) not allowing the whey to drain completely from the curd at wheying-off; (*c*) cooling water added to curd too soon, which firms the curd particles and prevents the complete escape of the whey.

Although cottage cheese is not in general use in Australia as a foodstuff, there is some demand for it in certain localities. Its manufacture serves a very useful purpose in as much as the cream is available for manufacture into butter and the skim milk is utilised for cottage cheese, thus giving the factory a worthwhile return. This kind of cheese is used as a savoury. It blends well with salads, but can also be served as a sweet in conjunction with stewed fruits, &c., and provides a valuable source of readily available proteins. It does not possess what is regarded as normal cheese flavour but has a pleasant, clean, acidic flavour.

Modern Milking Methods.

W. C. T. MAJOR, Dairy Technologist, Division of Dairying.

IN recent years research workers have revealed the intricate physiological mechanisms of the secretion and let-down of milk. A simple outline of these findings, and their application to the art of milking, should help farmers to understand modern milking methods.

Structure of the Udder.

The udder of the cow consists of four separate quarters. The diagram in Plate 1 will assist an understanding of its structure.

Each quarter of the udder contains:—

1. *Teat.*—The teat is closed at its lower end by a *sphincter muscle,* which prevents milk flowing from the udder, and restricts the entry into the udder of foreign bodies, including bacteria. The teat surrounds the *teat cistern* and communicates with the exterior via the *streak canal.*

2. *Milk Cistern.*—This is a small reservoir within the udder. It opens into the teat cistern.

3. *Milk Ducts.*—The milk ducts permeate the tissue of the udder. They open into the milk cistern.

4. *Alveoli.*—These are tiny, cell-lined sacs at the apex of the ducts. The transformation from blood plasma to milk occurs within the cells lining the alveoli.

5. *Blood Vessels, Muscles, Nerves.*—The tissue of the udder and teats is well supplied with blood vessels, muscles and nerves.

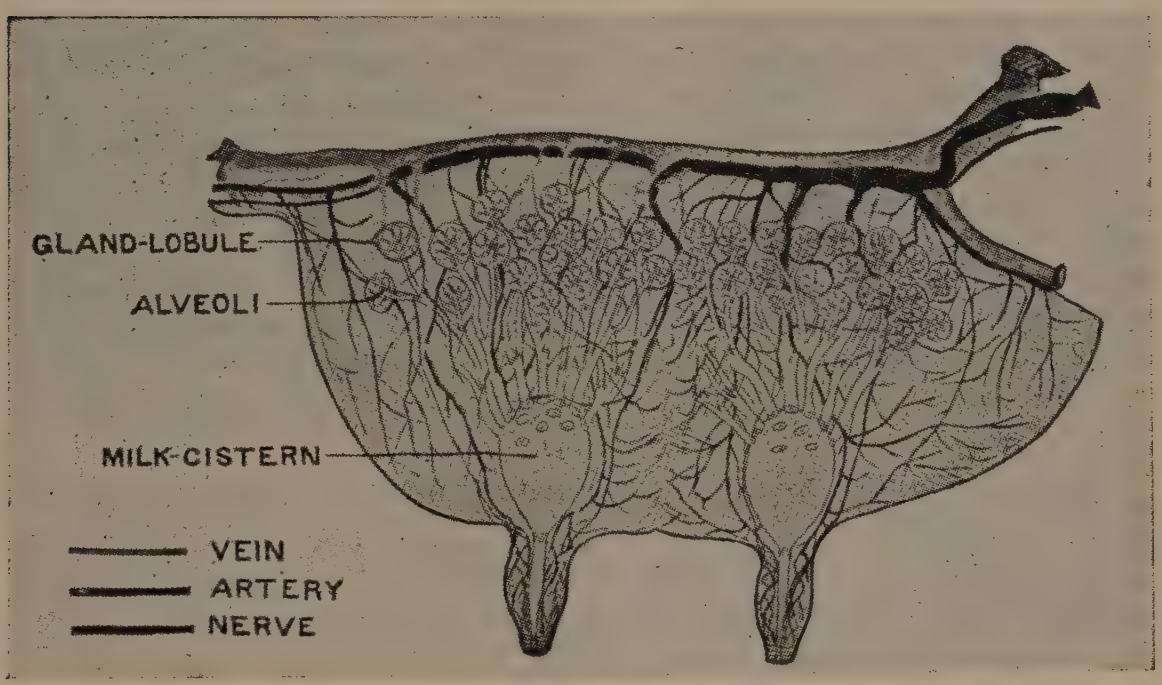


Plate 1.

Diagram of Section Through the Udder.

Secretion of Milk.

Substances digested from the cow's food supply are conveyed to the udder by the blood stream. Selected substances pass into the cells lining the alveoli, and are there manufactured into milk. This milk is secreted into the space within the alveoli. Milk first collects in the alveoli and then passes down the ducts into the udder and teat cisterns.

Not many years ago it was widely believed that milk secretion only occurred during milking. It has now been demonstrated that it takes place over a much longer period. The rate of secretion is influenced by the pressure developed within the udder. During milking the pressure within the udder falls and secretion commences. It continues until sufficient pressure develops within the udder to stop secretion. In normal, well-fed cows approximately eight hours elapse from the commencement of secretion until the rate of secretion commences to decrease considerably. However, it may be 14 hours before secretion apparently ceases—unless milk is removed from the udder during this interval.

Because of the influence of pressure on the rate of secretion, it is possible to increase the yield of heavy-producing cows by milking them three times a day. This increase may be as large as 15% of the twice-a-day yield when the cows are fed to the limit of their capacity. Regularly spaced milking intervals will also increase yields, irrespective of whether the cows are milked twice or three times per day. Milking at regular intervals is also desirable to obtain milk of uniform composition and particularly to avoid low-fat milk at certain seasons of the year with some breeds of heavy-milking dairy cattle.

Milk Let-Down.

Milk let-down, unlike secretion, is not a continuous process, but only occurs as the result of stimulation. The sucking of her calf is the strongest milk let-down stimulus a cow can receive. In normal milking this stimulus is best provided by adequately washing the cow's teats and udder with warm water (120°F.).

Stimulation of the nerve endings in the cow's teat causes an impulse to be transmitted to the pituitary gland at the base of the brain. This impulse causes the pituitary gland to release a hormone (oxytocin) into the blood stream. Oxytocin is carried by the blood stream to the udder, where it causes contraction of the muscle fibres surrounding the alveoli, thus developing additional pressure within the udder. It takes about 45 seconds from the stimulation of the teats until milk let-down occurs. Active muscular contraction persists for approximately six minutes. The bulk of the milk within the udder is held in the spongy secreting tissue and is most difficult to remove unless the tiny muscles permeating the tissue squeeze it out. It is therefore important to:—

(1) Commence milking one minute after washing the teats and udder.

(2) Milk fast enough to effectively empty the udder within four minutes.

Plate 2 illustrates the mechanism of milk let-down.

Cows normally associate with milking such actions as—

(1) Coming to the milking shed.

(2) The normal sounds of the shed.

(3) The milking routine.

In so doing cows develop a conditioned reflex, or habit, which stimulates milk let-down. Thus, cows with unwashed teats and udders can be trained to let down their milk. However, let-down due to habit alone is neither as definite nor as persistent as let-down due to habit supplemented by a warm udder wash. Correct stimulation permits more milk to be removed from the udder. It also permits milk to be removed more quickly.

Cows are susceptible to stimulation by hormones other than oxytocin and some have an important bearing on milking. For instance, fear, anger and frustration cause the suprarenal glands to secrete adrenalin into the blood stream. Adrenalin prevents contraction of the muscle fibres within the udder and so inhibits milk let-down by counteracting the effect of oxytocin. Therefore, handle cows quietly. Never excite them.

Thus, for complete milking, it is necessary to have:—

(1) A complete absence of counter stimuli, such as fear, anger, frustration and excitement.

(2) A definite udder and teat stimulation—preferably by a warm wash.

(3) Rapid removal of milk from the udder while the let-down stimulation still strongly persists.

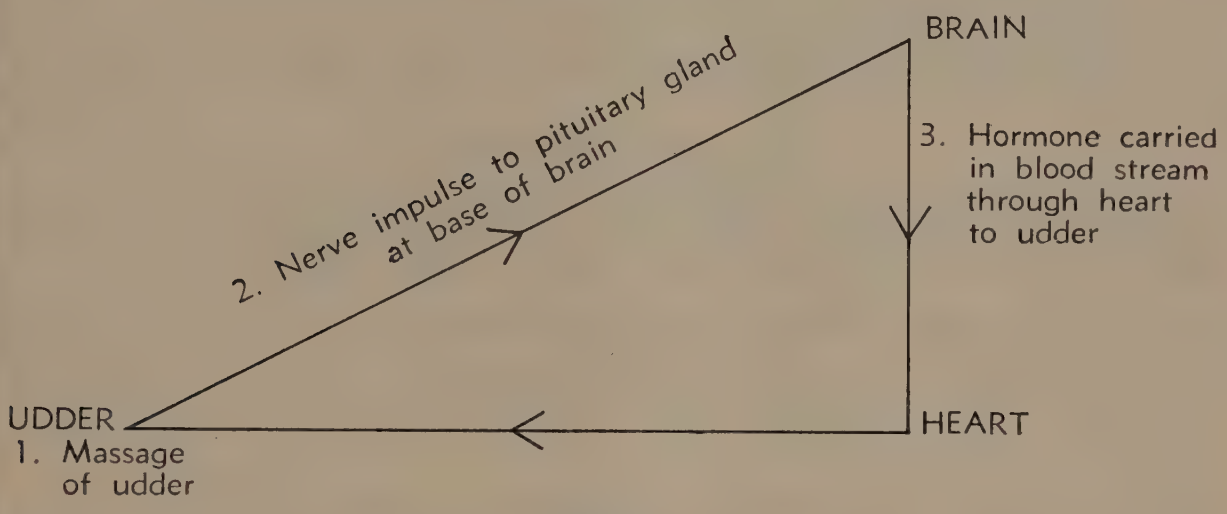


Plate 2.

Diagram of the Mechanisation of Milk Let-Down.

Hand-Milking.

During hand-milking the upper portion of the teat cistern is closed by the pressure of the hand. As the hand closes, the milk so trapped in the teat cistern is forced to issue from the teat. The pressure developed within the udder by secretion and muscular contraction causes milk to flow into the teat cistern as soon as the hand releases the teat. Hand-milking results in an intermittent flow of milk from two teats at a time.

Few milkers have either the ability or the endurance to consistently remove milk from cows quickly enough to completely empty the udder before the effect of the let-down stimulation has markedly decreased. With hand-milking, the milker is the limiting factor in milk removal—not the cow.

Machine-Milking.

Milk is removed from the cow by suction during machine-milking. There is sufficient difference in pressure between the interior of the milking-machine cups and the interior of the udder to permit an almost continuous flow of milk from each teat.

The effect of squeeze-and-release induced by the pulsator is to massage the teat in order to maintain blood circulation in the teat and so avoid congestion and discomfort. Unless the squeeze interval is

long enough to retard milk flow (as may occur with slack, soft inflations), the rate of squeeze to release has little effect on the rate of milking. The effective flow of air through the milking machine influences the rate of milking more than any other factor—provided the machine is otherwise operating efficiently. Effective air flow is influenced by—

(1) Capacity and efficiency of the vacuum pump.

(2) Leaking joints, flaps and poorly seated pulsators.

(3) Sensitivity of the relief valve.

(4) Cleanliness of the air admission hole.

Provided that milking machines are in good mechanical condition, the cow, rather than the machine, is the limiting factor in the rate of machine-milking. Thus, for efficient machine-milking, it is important that—

(1) Cows are properly prepared.

(2) Machines are mechanically efficient.

(3) Shed layout and routine are designed for rapid milking.

The Art of Milking.

Cows are creatures of habit, and regularity in the routine of milking and feeding pays dividends. Do the same things, in the same order, at the same time, each day. The cows like it that way.

The following routine gives excellent results:—

(1) Before commencing milking, thoroughly prepare the milking equipment. It must all be thoroughly rinsed, cleaned and sterilized between milkings.

(2) Bring the cows quietly from the paddock to the dairy. Don't use savage dogs, whips or other harsh treatment. Well-trained cows do not require to be driven to the dairy.

(3) Milk the cows at regular intervals. This will increase production, and help to overcome low-fat problems which some milk suppliers experience during certain seasons of the year.

(4) At the yards provide drinking water, shade and protection from prevailing winds.

(5) Provide yards of adequate size to comfortably hold the cows. Dehorning makes cows quieter and reduces distress—especially of heifers.

(6) Train the cows to pass quietly through the yards and shed. This means more milk and less labour. Gentle handling, rapid milking, and feeding after milking will assist training. The well-trained cow regards milking as a pleasure. She comes into the bail of her own accord. She does not foul the bail. Cleaning problems are simplified and the dust menace is reduced.

(7) As the cows come into the shed they are bailed-up and legroped where necessary. Both operations can be dispensed with when the cows are well-trained. This not only reduces labour, but also simplifies milk-quality problems by avoiding potent sources of contamination.

(8) Wash the hands thoroughly before commencing to milk the herd and rinse them before milking each cow.

(9) When the cow comes into the bail, thoroughly wash and dry her teats and udder, using warm water and a clean cloth. It is an advantage to use a hypochlorite disinfectant in the water. As the disinfectant action of hypochlorites is rapidly destroyed by organic matter, it is necessary to renew the solution during milking. Teats must be thoroughly dried—otherwise a drop forms on the sphincter muscle, thus localising contamination at the very spot where it is least desirable.

(10) As soon as washing and drying are complete, take a few squirts from each teat into a strip cup. Examine for abnormalities. If abnormal, the cow should be held back until last and hand-milked.

(11) Place the cups on the cow's teats one minute after commencing to wash her teats and udder. This is important for rapid milking.

(12) As milk is removed from the udder there is a tendency for the cups to creep upwards on the teats. This closes off the teat cistern from the udder cistern and stops the removal of milk from the udder. It also causes the delicate inner lining of the cistern to rub on itself. This may result in an injury which permits bacteria to enter and cause mastitis.

When the cups creep—gently pull them down.

(13) As soon as active milk flow ceases (as indicated by the sight glass and the appearance and feel of the udder), *bear down gently on the cups.* Frequently milk flow becomes active again for a short time. Remove the cups as soon as this flow slows down. Never leave the cups on a cow after a free flow of milk has ceased. Leaving the cups on too long trains the cow to develop sluggish milking habits, which will decrease her yield and increase the cost of milking.

(14) After milking each cow, dip the cups in clean water and then in strong chlorinated water. This is particularly important where mastitis is troublesome. Never knowingly place cups on any quarter affected with mastitis.

(15) Then place the cups on the next freshly prepared cow. This routine is carried on until all of the cows have been milked.

(16) Start the separator at such a stage during milking that separation is almost completed when the last cow is finished milking. Separate to a fat content of not less than 34% in winter and 38% in summer. This has an important influence on cream quality as well as transport costs. Do not separate cream to contain more than 42% fat—very-high-fat creams mean high fat losses.

(17) As soon as practicable after milking, rinse the milking machine and all utensils with clean water. Then proceed with cleaning and sterilization.

(18) Clean up the manure, sweep and hose the shed floors and leave everything clean, neat and tidy for the subsequent milking.

(19) After milking feed the cows in clean, detached feeding stalls. The amount and nature of their supplementary feed depend on—

(*a*) Productive capacity of the cow.

(*b*) Nature and amount of the feed available in the paddock.

(*c*) Relative prices of feed and dairy produce.

Machine-Stripping.

The majority of cows can be trained to milk out completely in 3 to 4 minutes and to maintain production without hand stripping.

The advantages of machine-stripping are—

1. A very definite labour saving.
2. Faster milking; that is, more cows can be milked in a given time.
3. Milking becomes more attractive to labour.

Machine-stripping causes no loss of production and drying-off is not accelerated. It has also been claimed that machine-stripping leads to improved milk quality and lowered incidence of mastitis.

Cows must be trained to machine-stripping methods. This training involves:—

1. Adherence to the modern milking methods already outlined. Cows must be efficiently milked before machine-stripping is attempted.

2. Remove the cups 4 minutes after milking has commenced (or earlier if free flow ceases). Hand strip to determine the amount of strippings.

3. For several milkings remove the cups as soon as free flow of milk ceases. Bear down on cups for a few seconds before removal. *Do not hand strip.*

4. Then determine the amount of stripping recovered. It will be found that some cows have not milked out completely. These cows require further training. Treat them as follows:—

   (*a*) Very thoroughly wash and massage the teats and udder before milking is commenced.

   (*b*) Massage the udder gently during the last 2 minutes of milking.

   (*c*) Gently bear down on the cups during the last minute.

5. Check the effect of this treatment on the amount of milk remaining in the udder by hand stripping at weekly intervals. As soon as practicable progressively reduce the amount of udder massage and the duration of bearing down on the cups.

By these methods more than 80% of the herd can be trained to machine stripping. The remaining, apparently untrainable, cows are a problem. It is for the farmer to decide, on economic grounds, whether they are to be retained in the herd and milked last, or replaced by trainable heifers. Frequently, aged cows will only fully respond to training at the commencement of a lactation. A few cows require re-education at the commencement of each lactation.

Summary.

Modern milking methods involve—

(1) Correct stimulation of the cow.
(2) Gentle handling and correct training of the cow.
(3) Efficient milking machines.
(4) Shed and yards designed to permit rapid milking.
(5) No hand-stripping.

Remember:

Slow milking makes a cow a "stripper."
Rapid milking makes a cow a "milker."

Pure-Bred Dairy Cattle Production Recording.

Report for the Year 1951-52.

S. E. PEGG, Chief Adviser, Herd Recording Section.

THE 1951-52 season was very unfavourable for dairying. Over the greater part of the State little or no rain fell between March 1951 and February 1952; thus most of the State was in the throes of a drought for nine months of the season. Under these conditions it could only be expected that the number of cows recorded would be lower than in previous years and that the average production of cows which completed lactations would also be much lower. The drought caused many breeders to withdraw their herds from the scheme, and every credit must be given to those who continued to record throughout the year. The production records of the various animals must therefore be related to the adverse nature of the season in which the productions were recorded.

During the year 112 herds were submitted for recording, compared with 135 herds during 1950-51. This decrease in the number of herds can be attributed to seasonal conditions, which also caused 46 herds to be withdrawn.

Table 1 shows the number of herds of the various breeds recorded.

TABLE 1.

NUMBERS OF HERDS RECORDED.

Breed.	1950–51.	1951–52.
A.I.S.	52	39
Ayrshire	9	10
Friesian	3	2
Guernsey	13	9
Jersey	57	52
Dairy Shorthorn	1	—
Total	135	112

The total number of cows submitted for recording in 1951-52 was 1,177, compared with 1,320 in the preceding year. Cows which passed the required age-production standards numbered 377 (32.0%) compared with 615 (46.0%) in 1950-51; 508 cows failed and 292 were withdrawn. The particulars are given by breed in Table 2.

In Table 3, information is set out, for each year from 1942-43 to 1951-52, on the number of cows which passed, failed or were withdrawn.

The average production of all cows which completed lactations during the year was 5,571 lb. milk and 259 lb. butterfat; the average butterfat percentage was 4·65.

Table 4 gives the average production of cows which completed lactations of 273 days or less for each year since 1946-47.

Table 5 gives the average production for the various age-groups in each breed.

TABLE 2.

SUMMARY OF COWS WHICH PASSED, FAILED OR WERE WITHDRAWN, 1950-51 AND 1951-52.

Breed.		Total.		Passed.		Failed.		Withdrawn.	
		1950–51.	1951–52.	1950–51.	1951–52.	1950–51.	1951–52.	1950–51.	1951–52.
A.I.S.	No.	471	407	196	118	221	181	54	108
	%	—	—	41·6	29·0	46·9	44·5	11·5	26·5
Ayrshire	No.	69	79	29	29	29	30	11	20
	%	—	—	42·0	36·7	42·0	38·0	15·9	25·3
Friesian	No.	26	18	9	7	9	9	8	2
	%	—	—	34·5	38·9	34·5	50·0	30·9	11·1
Guernsey	No.	129	78	64	24	47	46	18	8
	%	—	—	49·6	30·8	36·4	58·9	14·0	10·3
Jersey	No.	621	595	317	199	228	242	76	154
	%	—	—	51·0	33·4	36·7	40·7	12·2	25·0
Dairy Shorthorn ..	No.	4	—	—	—	4	—	—	—
	%	—	—	—	—	100	—	—	—
Total	No.	1,320	1,177	615	377	538	508	167	292
	%	—	—	46·6	32·0	40·8	43·2	12·6	24·8

TABLE 3.

SUMMARY OF COWS WHICH PASSED, FAILED OR WERE WITHDRAWN, 1942–43 TO 1951–52.

Year.	Passed.	Failed.	Withdrawn.	Total.
1942–43	249	60	..	..
1943–44	199	74	..	..
1944–45	278	112	60	450
1945–46	363	113	92	568
1946–47	366	80	262	708
1947–48	421	200	263	884
1948–49	759	305	363	1,427
1949–50	680	384	257	1,321
1950–51	615	538	167	1,320
1951–52	377	508	292	1,177

TABLE 4.

AVERAGE PRODUCTION OF COWS WHICH COMPLETED LACTATIONS, 1946–47 TO 1951–52.

Year.	No. of Cows.	Average Production.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
1946–47	446	6,580	4·95	326
1947–48	621	6,981	4·67	326
1948–49	1,064	6,783	4·76	323
1949–50	1,064	6,608	4·69	310
1950–51	1,153	5,917	4·58	271
1951–52	885	5,571	4·65	259

TABLE 5.

BREED PRODUCTION AVERAGES FOR REGISTERED HERD BOOK STOCK WHICH COMPLETED LACTATION RECORDS OF 273 DAYS OR LESS DURING THE YEAR ENDING 30TH JUNE, 1952.

Breed.		J.2.	S.2.	J.3.	S.3.	J.4.	S.4.	Mature.	All Ages.
A.I.S.	No. of Cows	113	56	28	17	15	12	58	299
	Milk (lb.)	5,551	5,755	6,473	6,409	6,776	5,423	7,891	6,229
	Butterfat (lb.)	224	233	262	254	285	204	317	251
	Test (%)	4·0	4·0	4·0	4·0	4·3	3·8	4·0	4·0
Ayrshire	No. of Cows	22	13	4	3	2	4	11	50
	Milk (lb.)	5,814	6,794	6,587	7,271	7,140	7,817	5,912	6,356
	Butterfat (lb.)	243	290	259	288	323	326	247	266
	Test (%)	4·2	4·3	3·9	4·0	4·5	4·2	4·2	4·2
Friesian	No. of Cows	5	2	3	2	..	..	4	16
	Milk (lb.)	6,219	8,086	7,272	7,271	..	..	6,789	6,294
	Butterfat (lb.)	214	290	280	283	..	..	301	267
	Test (%)	3·4	3·6	3·9	3·9	..	..	4·4	3·9
Guernsey	No. of Cows	21	5	5	4	9	4	22	70
	Milk (lb.)	4,739	4,804	6,207	6,646	6,944	6,538	5,669	5,637
	Butterfat (lb.)	231	224	298	319	301	286	214	262
	Test (%)	4·9	4·7	4·8	4·8	4·3	4·4	4·5	4·7
Jersey	No. of Cows	172	53	46	36	17	23	94	441
	Milk (lb.)	4,351	4,816	5,012	5,089	4,906	5,927	5,961	4,983
	Butterfat (lb.)	227	251	265	267	271	303	319	262
	Test (%)	5·3	5·2	5·3	5·3	5·5	5·1	5·4	5·3

All ages and all breeds:—No. of Cows, 885; Milk, 5,571 lb.; Butterfat, 259 lb.; Test, 4·6%.

TABLE 6.

COWS WHICH HAVE PRODUCED BUTTERFAT EQUIVALENT TO 1,000 LB. COMMERCIAL BUTTER IN ONE LACTATION.

Name of Cow.	Owner.	Breed.	Date of Calving.	Age.	Days in Lactation.	Milk.	Test.	Butterfat.	Estimated Commercial Butter.
				Y. M.		Lb.	%	Lb.	Lb.
Fairvale Laurel 2nd	W. Henschell	A.I.S.	14–9–49	6 3	365	28,884	3·6	1,062	1,295
Charmer 2nd of City View	M. Lawrence	A.I.S.	1920	6 3	365	21,304	4·5	949	1,167
Gem May	W. Bishop	Jersey	11–10–46	9 9	365	15,065	6·1	924	1,127
Alfa Vale Model 4th	W. H. Thompson	A.I.S.	3–7–41	9 0	365	19,151	4·8	922	1,124
Alfa Vale Model 2nd	W. H. Thompson	A.I.S.	1–6–40	10 9	328	18,530	4·9	904	1,102
Evelyn of Sunnyview	J. Phillips	A.I.S.	18–8–33	6 11	273	22,575	4·0	904	1,102
Alfa Vale Nellie 4th	W. H. Thompson	A.I.S.	12–4–39	6 4	365	23,889	3·7	890	1,085
Alfa Vale Pansy	W. H. Thompson	A.I.S.	2–8–42	4 11	365	19,824	4·5	887	1,082
Alfa Vale Gem 4th	W. H. Thompson	A.I.S.	26–7–37	5 0	365	21,325	4·1	884	1,078
Alfa Vale Laura	W. H. Thompson	A.I.S.	4–7–39	5 8	365	23,158	3·7	858	1,046
Alfa Vale Model 4th	W. H. Thompson	A.I.S.	3–4–40	7 10	365	19,106	4·4	847	1,033
Alfa Vale Model 29th	W. H. Thompson	A.I.S.	8–5–48	3 5	349	17,635	4·8	847	1,033
Valera Sheila	Sullivan Bros.	A.I.S.	13–3–38	7 4	365	16,239	5·2	847	1,033
Penrhos Pansy	A. Sandilands	A.I.S.	25–5–35	7 3	273	17,603	4·7	844	1,029
Alfa Vale Model 3rd	W. H. Thompson	A.I.S.	12–8–36	6 1	365	18,734	4·4	835	1,018
College Princess Pontiac	Hickey and Sons	Friesian	3–5–32	7 10	365	24,027	3·4	830	1,012
Kilburnie Ethel 3rd	Macfarlane Bros.	A.I.S.	5–7–33	7 11	365	18,108	4·6	829	1,011
Blossom of Penrhos	A. Sandilands	A.I.S.	10–8–31	6 5	365	18,933	4·3	824	1,005

New Production Records.

During the year there was one new 273-days production record established. This was for the Ayrshire breed in the Senior 2 age-group; it is all the more meritorious because of the adverse seasonal conditions prevailing. The new record was established by "Auchen Eden Trixie 2nd," (Plate 1) who produced 10,680 lb. milk yielding 511 lb. butterfat; the average butterfat content of her milk was 4·8%. This animal was bred by Mr. J. N. Scott, "Auchen Eden," Camp Mountain, and was sired by "Oatlands Duke." The dam is "Auchen Eden Thistle." Her lactation was continued to 365 days and in this period she produced 12,986 lb. milk and 635 lb. butterfat. This is also a record production for an Ayrshire Senior 2-year-old over a 365-day period. The previous 273-days lactation record of an Ayrshire cow was 9,683 lb. milk and 415 lb. butterfat, established in 1950 by "Crescent Farm Monnie," owned by Mr. N. J. Mann, Broxburn.

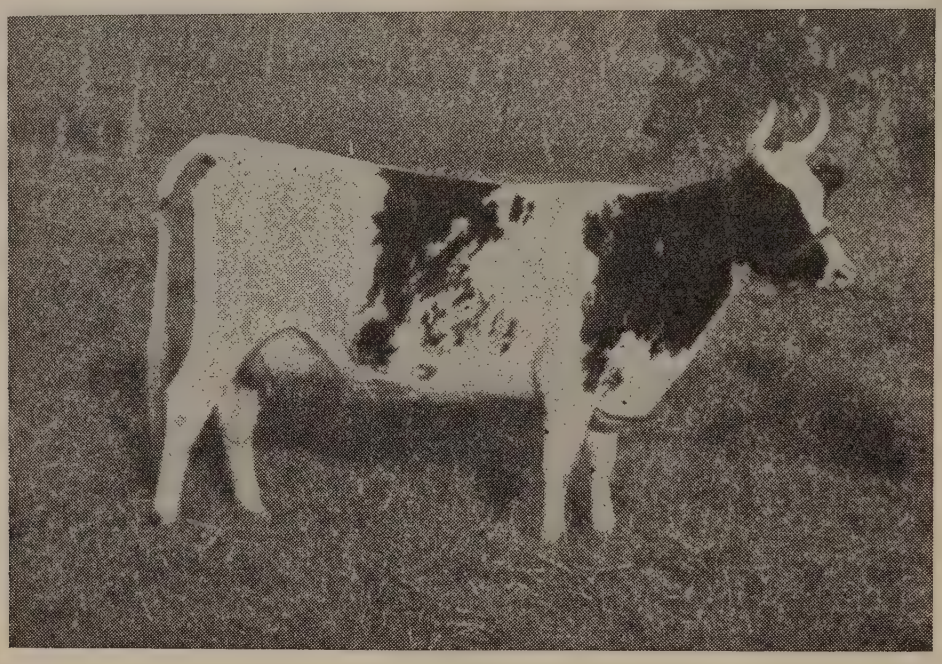


Plate 1.

"Auchen Eden Trixie 2nd," owned by Mr. J. N. Scott, "Auchen Eden," Camp Mountain. This animal established a new production record for the Ayrshire Senior 2-year-old age-group. Her production was 10,680 lb. milk and 511 lb. butterfat. The average butterfat content was 4.8%.

Highest Production during the Year.

The highest production recorded during the year was of the A.I.S. cow "Fairvale Laurel 2nd" (Plate 2) (owned by Mr. W. Henschell), who produced 16,095 lb. milk and 645 lb. butterfat; her average test was 4·0%. In the previous lactation this animal produced 23,094 lb. milk and 853 lb. butterfat in 273 days, and 28,884 lb. milk and 1,062 lb. butterfat in 365 days.

Table 6 lists all cows which have produced at least 820 lb. butterfat (equivalent to 1,000 lb. commercial butter) in a single lactation.

Tables 7 and 8 give the existing individual production records, according to age-groups, of the different breeds of dairy cattle for lactation periods of 273 days and 365 days respectively. Although much more importance is attached to the lifetime production of cows, these records of individual lactation productions are still of great interest.

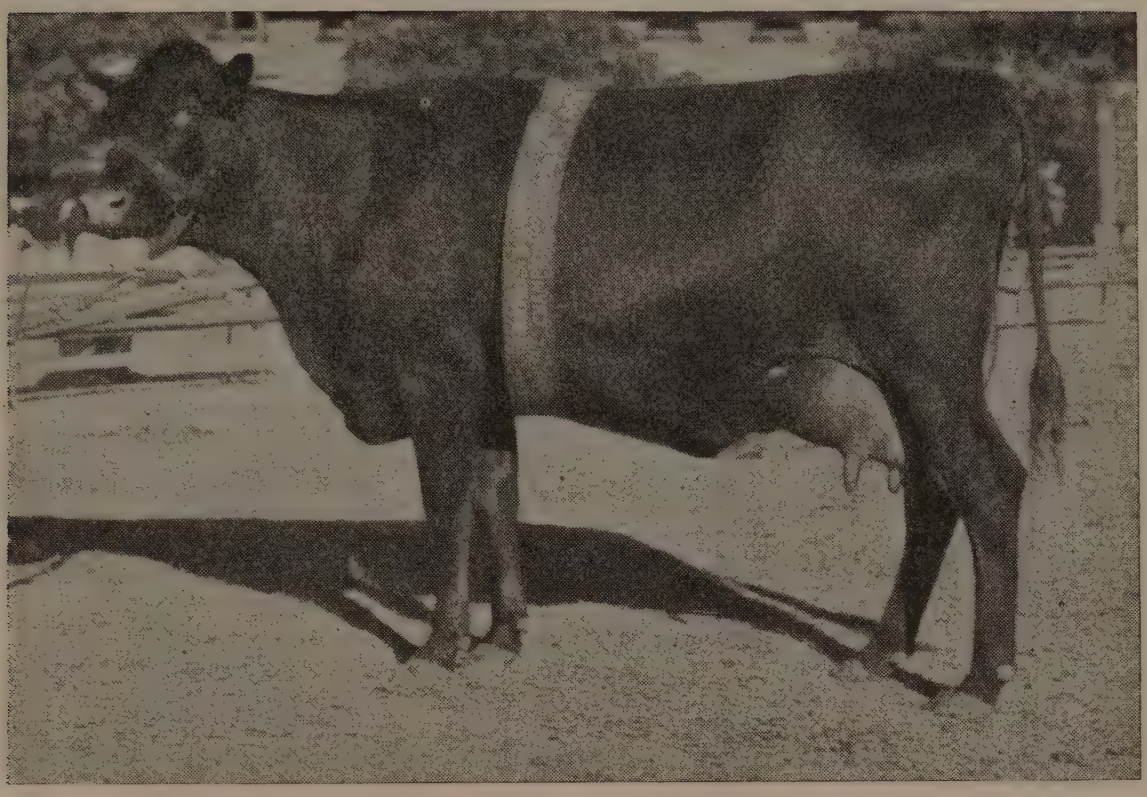


Plate 2.

"Fairvale Laurel 2nd," owned by Mr. W. Henschell, "Yarranvale," Yarranlea, was the highest producing cow for 1951-52. Her production was 16,095 lb. milk and 645 lb. butterfat.



Plate 3.

"Glendalough Cissy," owned by Dr. D. Gordon, 17 Mile Rocks, Brisbane. As a Senior 2-year-old she produced 8,333 lb. milk and 304 lb. butterfat. The average butterfat content was 3.6%.

TABLE 7.

EXISTING PRODUCTION RECORDS FOR 273 DAYS FOR VARIOUS AGE GROUPS IN EACH BREED.

Age.	Cow.	Owner.	Year of Test.	Milk.	Test.	Butterfat.
				Lb.	%	Lb.
		A.I.S.				
J.2 ..	Diana 17th of Kelston	A. Frank, Boonah	1930	13,604	4·20	572
S.2 ..	Alfa Vale Model 16th	W. H. Thompson, Nanango	1942	12,783	5·00	640
J.3 ..	Alfa Vale Model 29th	W. H. Thompson, Nanango	1949	14,516	4·07	691
S.3 ..	Sunnyview Beauty 6th	J. Phillips, Wondai	1948	16,577	4·42	733
J.4 ..	Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	1936	15,186	4·57	695
S.4 ..	Kyabram Mab	C. W. Black, Kumbia	1940	16,963	4·32	733
Mature..	Sunnyview Evelyn	J. Phillips, Wondai	1933	22,575	4·00	904
		JERSEY.				
J.2 ..	Inverlaw Phyllis	R. J. Crawford, Kingaroy	1940	9,756	5·57	544
S.2 ..	Hamilton White Rose	J. Wilton, Killarney	1934	8,060	6·52	526
J.3 ..	Lyndhurst Mollie	J. B. Keys, Gowrie	1931	11,828	4·83	571
S.3 ..	Oxford Jezebel	E. Burton and Sons, Wanora	1941	10,950	5·88	644
J.4 ..	Oxford Buttercup 4th	E. Burton and Sons, Wanora	1922	11,331	5·93	672
S.4 ..	Trecarne Dairymaid	T. A. Petherick, Lockyer	1940	9,584	7·31	701
Mature..	Brookland Cunning Drop	W. S. Conochie, Sherwood	1948	12,800	5·87	752
		GUERNSEY.				
J.2 ..	Linwood Feather	A. S. Cooke, Maleny	1944	9,183	4·42	406
S.2 ..	Springvale Verla	A. Ruge and Sons, Woowoonga	1950	8,517	5·34	455
J.3 ..	Bangalow Vale Vanity Fair 3rd	W. A. K. Cooke, Maleny	1948	9,664	4·81	465
S.3 ..	Linwood Sister	A. S. Cooke, Maleny	1944	8,992	5·02	452
J.4 ..	Laureldale Vera	W. A. K. Cooke, Maleny	1945	9,599	4·96	476
S.4 ..	Laureldale Vida	W. A. K. Cooke, Maleny	1946	10,313	4·82	498
Mature..	Laureldale Vida	W. A. K. Cooke, Maleny	1948	12,473	4·51	563
		AYRSHIRE.				
J.2 ..	Myola Gem 2nd	J. R. and R. M. Anderson, Yandilla	1937	12,578	3·74	472
S.2 ..	Auchen Eden Trixie 2nd	J. N. Scott, Camp Mountain	1951	10,680	4·78	511
J.3 ..	Myola Lady Tina	J. R. and R. M. Anderson, Yandilla	1937	8,126	4·77	388
S.3 ..	Myola Jollity	J. R. and R. M. Anderson, Yandilla	1936	10,995	4·34	477
J.4 ..	Crescent Farm Joyous	N. J. Mann, Broxburn	1950	10,848	3·79	411
S.4 ..	Myola Lady Jean	J. R. and R. M. Anderson, Yandilla	1938	14,377	4·76	685
Mature..	Fairview Vesta	J. R. and R. M. Anderson, Yandilla	1938	10,856	4·87	529
		FRIESIAN.				
J.2	Ryfield Dairymaid 8th	P. Falt, Cushine	1937	8,139	4,54	370
S.2 ..	St. Athan's Bee	W. Newman, Wyreema	1930	14,143	3·12	442
J.3 ..	St. Athan's Piebe Molly	F. C. Noller, Kumbia	1936	11,813	3·69	436
S.3 ..	Brigalow Gem 2nd	A. O. Stumer, Boonah	1934	9,801	3·76	369
J.4 ..	Tent Hill Princess	W. H. Grams, Gatton	1938	11,366	3·62	412
S.4 ..	Stonybrae Belle	Hickey and Sons Pty. Ltd., Wilston	1930	11,156	3·69	412
Mature..	College Princess Pontiac	Hickey and Sons Pty. Ltd., Wilston	1932	19,315	3·40	657

TABLE 8.

EXISTING PRODUCTION RECORDS FOR 365 DAYS FOR VARIOUS AGE GROUPS IN EACH BREED.

Age.	Cow.	Owner.	Year of Test.	Milk.	Test.	Butterfat.
		A.I.S.		Lb.	%	Lb.
J.2 ..	Diana 17th of Kelston	A. Frank, Boonah	1930	17,430	4·14	721
S.2 ..	Alfa Vale Pansy	W. H. Thompson, Nanango	1940	16,237	4·59	746
J.3 ..	Greyleigh Gem 139th	W. H. Thompson, Nanango	1943	16,825	4·46	751
S.3 ..	Alfa Vale Gem 7th	W. H. Thompson, Nanango	1940	14,649	4·92	721
J.4 ..	Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	1936	17,369	4·71	818
S.4 ..	Alfa Vale Pansy	W. H. Thompson, Nanango	1942	19,824	4·47	887
Mature..	Fairvale Laurel 2nd	W. Henschell, Yarranlea	1951	28,884	3·68	1,062
		JERSEY.				
J.2 ..	Inverlaw Phyllis	R. J. Crawford, Kingaroy	1940	12,472	5·85	730
S.2. ..	Hamilton White Rose	J. Wilton, Killarney	1934	9,812	6·66	654
J.3 ..	Lyndhurst Marella	J. B. Keys, Gowrie	1932	11,225	5·44	611
S.3 ..	Lavender of Calton	E. Burton and Sons, Wanora	1933	15,249	5·07	773
J.4 ..	Does not exceed the record for 273 days					
S.4 ..	Does not exceed the record for 273 days					
Mature..	Gem May	W. Bishop, Kenmore	1947	15,065	6·13	924
		GUERNSEY.				
J.3 ..	Laureldale Pamela	W. A. K. Cooke, Maleny	1948	11,698	4·86	569
		AYRSHIRE.				
S.2 ..	Auchen Eden Trixie 2nd	J. N. Scott, Camp Mountain	1951	12,986	4·9	635
		FRIESIAN.				
S.2 ..	St. Athan's Bee	W. Newman, Wyreema	1930	18,008	3·13	564
Mature..	College Princess Pontiac	Hickey and Sons Pty. Ltd., Wilston	1932	24,027	3·45	830

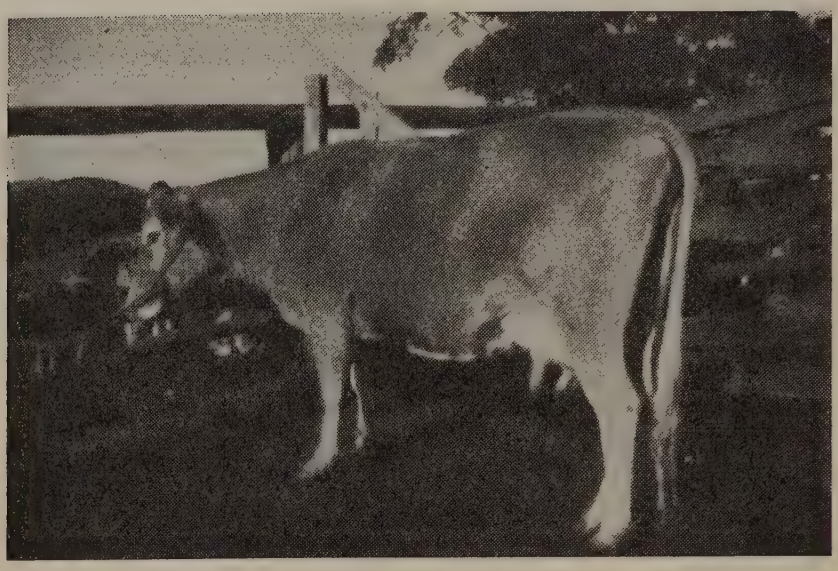


Plate 4.

"Willowbrae Daffodil," owned by Messrs. Ruge & Sons, "Woowoonga," Biggenden, was the highest producing Guernsey cow. As a Junior 4 she produced 9,421 lb. milk and 439 lb. butterfat. The average butterfat test was 4.7%.



Plate 5.

"Trecarne Chiming 2nd," owned by Mrs. I. L. M. Borchert, "Willowbank," Kingaroy. She produced 9,169 lb. milk and 499 lb. butterfat as a Senior 2-year-old.

Some particulars of the 1951-52 season leaders for each age group in each breed are given in Table 9.

TABLE 9.

CLASS LEADERS IN EACH AGE GROUP FOR BUTTERFAT PRODUCED IN 273 DAYS DURING 1951–52.

Age Class.	Cow.	Owner.	Milk.	Test.	Butter-fat.
			Lb.	%	Lb.
		A.I.S.			
J.2 ..	Yarranvale Gem ..	W. Henschell, Yarranlea	8,138	4·2	344
S.2 ..	Arolla Pet 3rd	J. Crookey, Allora ..	9,249	4·4	404
J.3 ..	St. Andrew's Honeycombe 3rd	M. C. Lester, Glengallan, Warwick	10,695	4·1	442
S.3 ..	St. Andrew's Envy ..	M. C. Lester, Glengallan, Warwick	11,768	3·9	460
J.4 ..	Cedar Valley Rosette ..	J. H. Fogg, Toogoolawah	9,145	3·9	357
S.4 ..	No animal reached the standard				
M ..	Fairvale Laurel 2nd ..	W. Henschell, Yarranlea	16,095	4·0	645
		AYRSHIRE.			
J.2 ..	Holm Park Jaunty ..	L. and N. Norgaard, Nara	7,332	4·8	354
S.2 ..	Auchen Eden Trixie 2nd	J. N. Scott, Camp Mountain	10,680	4·8	511
J.3 ..	Iona Jollity	St. Christopher's Lodge, Brookfield	7,188	4·0	285
S.3 ..	Auchen Eden Thistledown	J. N. Scott, Camp Mountain	7,977	4·5	361
J.4 ..	Auchen Eden Truda ..	J. N. Scott, Camp Mountain	7,199	4·8	348
S.4 ..	Eleresley Flirt	Stimpson Ltd., Loganlea	8,144	4·6	374
M ..	Auchen Eden Thalia ..	J. N. Scott, Camp Mountain.	8,760	4·9	430
		FRIESIAN.			
J.2 ..	Yarrabine Molly's Robe..	C. H. Naumann, Yarraman	7,015	3·6	251
S.2 ..	Glendalough Cissy ..	D. Gordon, Oxley ..	8,333	3·6	304
J.3 ..	Burnbrae Myra Colantha	D. Gordon, Oxley ..	7,988	3·9	313
S.3 ..	Burnbrae Adeline Colantha	D. Gordon, Oxley ..	9,069	3·7	339
J.4 ..	..	..	..	..	..
S.4 ..	..	..	..	..	..
M ..	..	..	..	..	..
		GUERNSEY.			
J.2 ..	Woowoonga Jubilee ..	A. Ruge and Sons, Woowoonga	7,565	4·5	339
S.2 ..	San Jonda Bright Eyes ..	W. H. Doss, Degilbo ..	6,320	5·1	320
J.3 ..	Willowbrae Tossells ..	A. Ruge and Sons, Woowoonga	6,507	5·1	332
S.3 ..	Springvale Verla ..	A. Ruge and Sons, Woowoonga	8,286	4·9	407
J.4 ..	Willowbrae Daffodil ..	A. Ruge and Sons, Woowoonga	9,421	4·7	439
S.4 ..	..	..	..	..	..
M ..	Willowbrae Poppy ..	E. G. Foxton, Maleny ..	8,666	4·6	396
		JERSEY.			
J.2 ..	Glenrandle Gleam Girl ..	P. Kerlin, Killarney ..	6,551	5·7	375
S.2 ..	Trecarne Chiming 2nd ..	Mrs. I. L. M. Borchert, Kingaroy	9,169	5·4	499
J.3 ..	Romsey Lady Fox ..	J. Wilton, Killarney ..	6,616	6·1	401
S.3 ..	Glen Erin Princess 2nd ..	J. S. McCarthy, Greenmount	9,110	4·9	446
J.4 ..	Glenrandle Joan ..	P. Kerlin, Killarney ..	6,122	6·1	374
S.4 ..	Windsor Royal Ruth ..	H. G. Johnson, Gleneagle	8,393	5·4	452
M ..	Glenrandle Verabelle ..	P. Kerlin, Killarney ..	8,798	5·7	499

Withdrawals from Recording.

During the year permission was given to withdraw 292 cows from test. The number and percentage of cows withdrawn for various reasons is given according to breed in Table 10. Most of the withdrawals are due to the whole of the herd having been withdrawn owing to the drought; these amounted to 261 head, or 89·4% of all withdrawals.

TABLE 10.

CAUSES FOR WITHDRAWAL FROM RECORDING AND NUMBER OF COWS WITHDRAWN, ACCORDING TO BREED AND CAUSE.

Cause.	A.I.S.	Ayrshire.	Friesian.	Guernsey.	Jersey.	All Breeds.	Percentage of Withdrawals.
Mastitis	..	..	..	..	1	1	·3
Footrot	1	..	..	..	..	1	·6
Sickness	3	3	1	..	3	10	3·4
Herd Withdrawn..	98	15	..	8	140	261	89·4
Sold	3	..	..	..	4	7	2·4
Died	1	..	1	..	5	7	2·4
Culled	1	..	..	..	1	2	·6
Accident	1	2	..	..	..	3	·9
Totals ..	108	20	2	8	154	292	..

Short Lactation Periods.

During the year, 156, or 17·64%, of the cows which completed their lactation periods were milked for less than 273 days, compared with 16·2% in the previous year. It has been shown from surveys of data from grade herd recording that production is closely linked with the length of lactation. The relatively high proportion of cows with short lactations indicates the necessity for stud breeders to concentrate on strains or families which are capable of milking for a lactation period of at least 273 days.

Table 11 shows the numbers and percentages of cows in each age-group of the respective breeds which milked for lactation periods of less than 273 days.

TABLE 11.

NUMBERS AND PERCENTAGES of COWS IN AGE-GROUPS AND BREEDS WHICH HAD LACTATION PERIODS OF LESS THAN 273 DAYS.

Breed.		J.2.	S.2.	J.3.	S.3.	J.4.	S.4.	Mature.	Total.
A.I.S.	No.	23	15	8	3	6	5	19	79
	%	20·4	26·8	28·6	17·6	40·0	41·7	32·8	26·4
Ayrshire	No.	2	..	..	1	..	..	5	8
	%	9·1	..	..	33·3	..	..	45·5	13·6
Friesian	No.	..	..	..	..	..	..	..	..
	%	..	..	..	..	..	..	..	..
Guernsey	No.	..	1	..	..	..	..	5	6
	%	..	20·0	..	..	..	..	22·7	8·6
Jersey	No.	22	7	5	12	3	4	10	63
	%	12·8	13·2	10·9	33·3	17·6	17·4	10·6	14·3
All Breeds	No.	47	23	13	16	9	9	39	156
	%	14·1	22·1	15·1	25·8	20·9	20·9	20·6	17·6

Further Information.

Details of all cows which completed lactations during the year will be published in subsequent issues of this journal as space permits. A preliminary survey of sires will also appear.

Useful Cattle Feeding Stalls.

J. ARBUCKLE, Adviser in Cattle Husbandry.

THE need for higher production from Queensland's dairy herds has increased the urgency for a greater measure of fodder conservation in order that milking cows may be adequately fed during the drier months of each year. Dairying is similar to any other business enterprise, and increased expenditure on fodder conservation can only be justified when the increased production resulting from the better feeding of the herd is sufficient to pay the cost of storage and feeding-out. It is essential, therefore, that the farmer who has decided to supplement his pastures with conserved roughages make provision for the feeding of these roughages by a smooth-working, labour-saving system.

The plans presented in Plates 1-3 are of stalls used successfully by Messrs. H. J. Kraatz and Sons, of Etna Creek, whose courtesy in making the design available for publication is appreciated.

The plan is designed primarily for the feeding of silage from two silos situated at one end of the stalls. The cattle enter the stalls from the end opposite the silos by a 7 ft. laneway behind each set of stalls. Slight modifications of the ground plan will make the scheme equally convenient for the feeding of hay. Alternatively, should only 20 or fewer stalls be required, where hay is being fed the stalls could run along the length of the hayshed and be covered by a lean-to, preferably on the weather side of the shed, as this would add extra protection to the hay from damage by weather.

It is recommended that, where finance is available, the stalls be roofed, preferably with iron. Roofing protects the timber and ensures clean, dry feeding conditions during wet weather.

Concrete flooring, at least of the actual feeding space, is also recommended, but where finance is not available for concrete, cinders and gravel are useful substitutes.

The plan requires a depth of 38 ft. with a length depending on the number of stalls built, which is optional.

The depth is made up of a 7 ft. lane behind each set of stalls to facilitate movement of cattle in and out of the enclosure; two sets of stalls each 9 ft. deep; and a 6 ft. space between the rows of stalls.

A tram track 2 ft. to 2 ft. 6 in. wide is run down the central laneway to carry the fodder waggon. A very slight fall away from the silos makes the task of pushing the loaded waggon considerably easier.

The 7 ft. roadway at the back of the stalls should be enclosed by a post-and-rail fence. The actual stall is formed by 5 x 5 posts at the head and rear of each stall, with three 5 x 2 rails between each stall, the top rail being set 4 ft. from the ground. The distance from centre to centre of the posts is 2 ft. 6 in., giving an overall clearance between posts of 25 in. At the head of the stalls, every fourth post is replaced by a round post 6 in. in diameter in order to allow roof supports to be added.

By means of sliding gates at the rear of the stalls, cattle can be controlled from the central laneway. This is done by pulling the cord at each individual stall to open the gate. As shown in Plate 3, the cord runs from the top of the gate through a pulley attached to the outside top member and down to a bent nail or hook above the feed

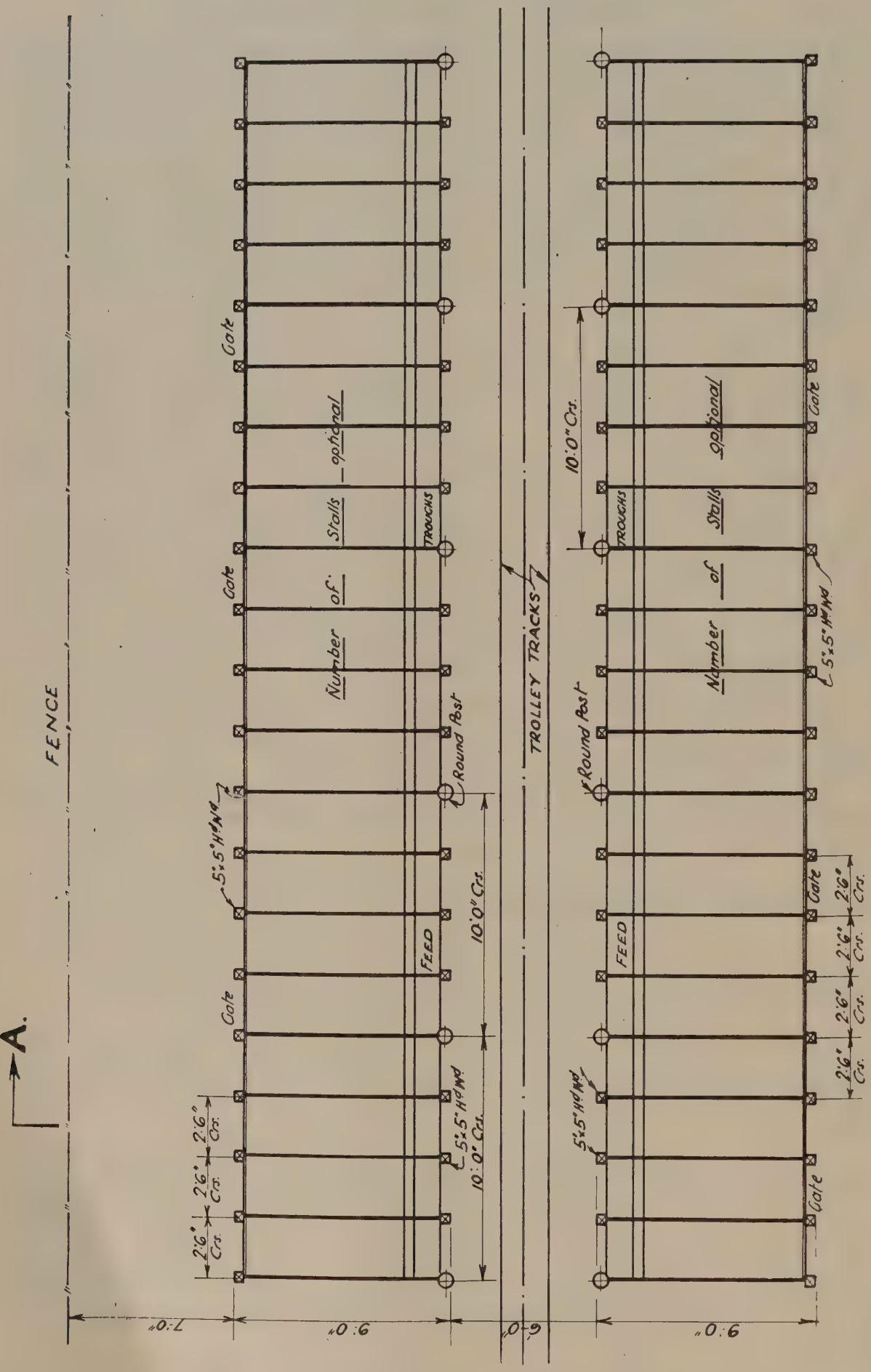


Plate 1.

Plan of Feeding Stalls. The laneway behind one set of stalls is not shown.

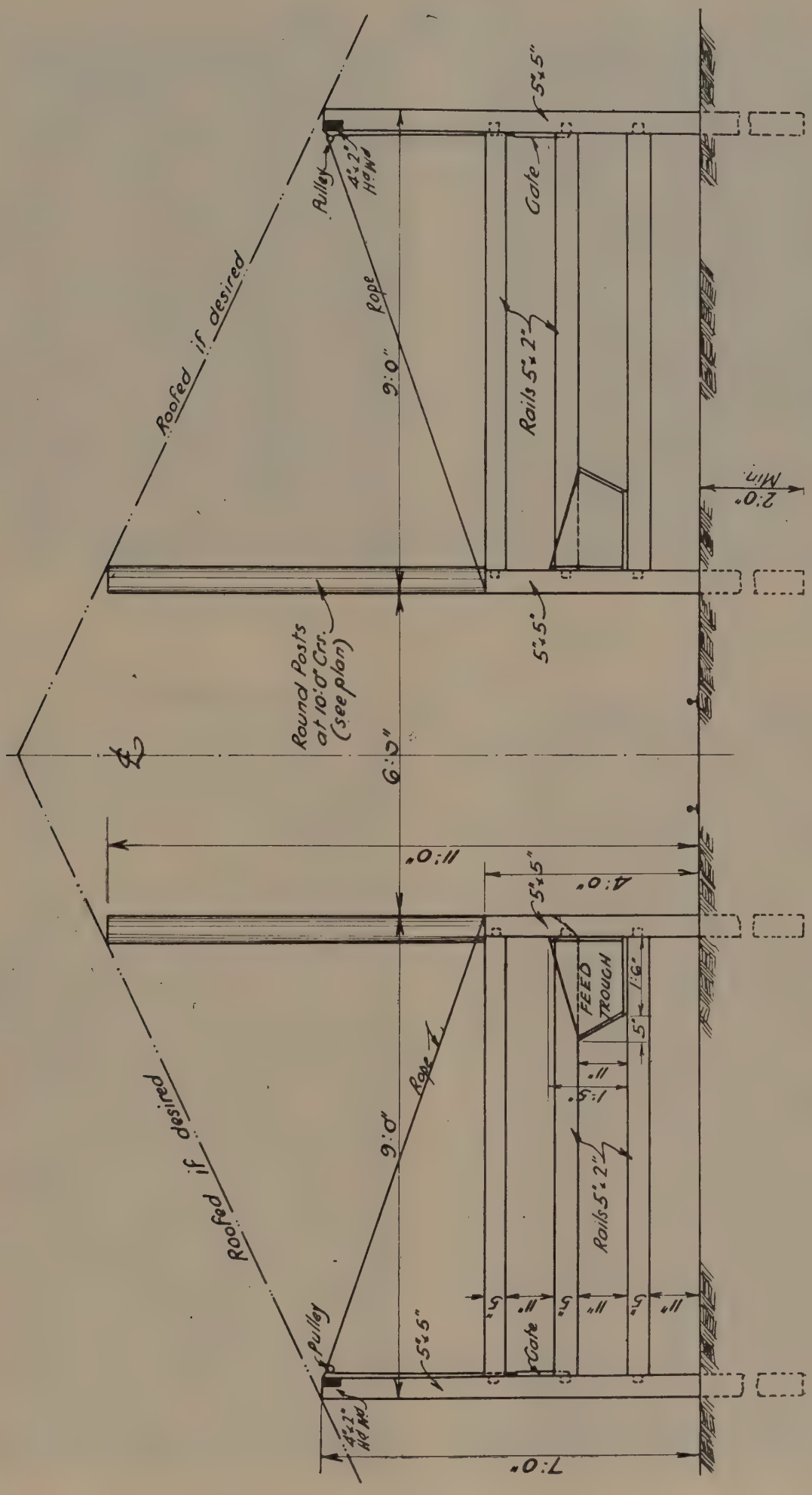


Plate 2.

Sectional View Through Stalls.

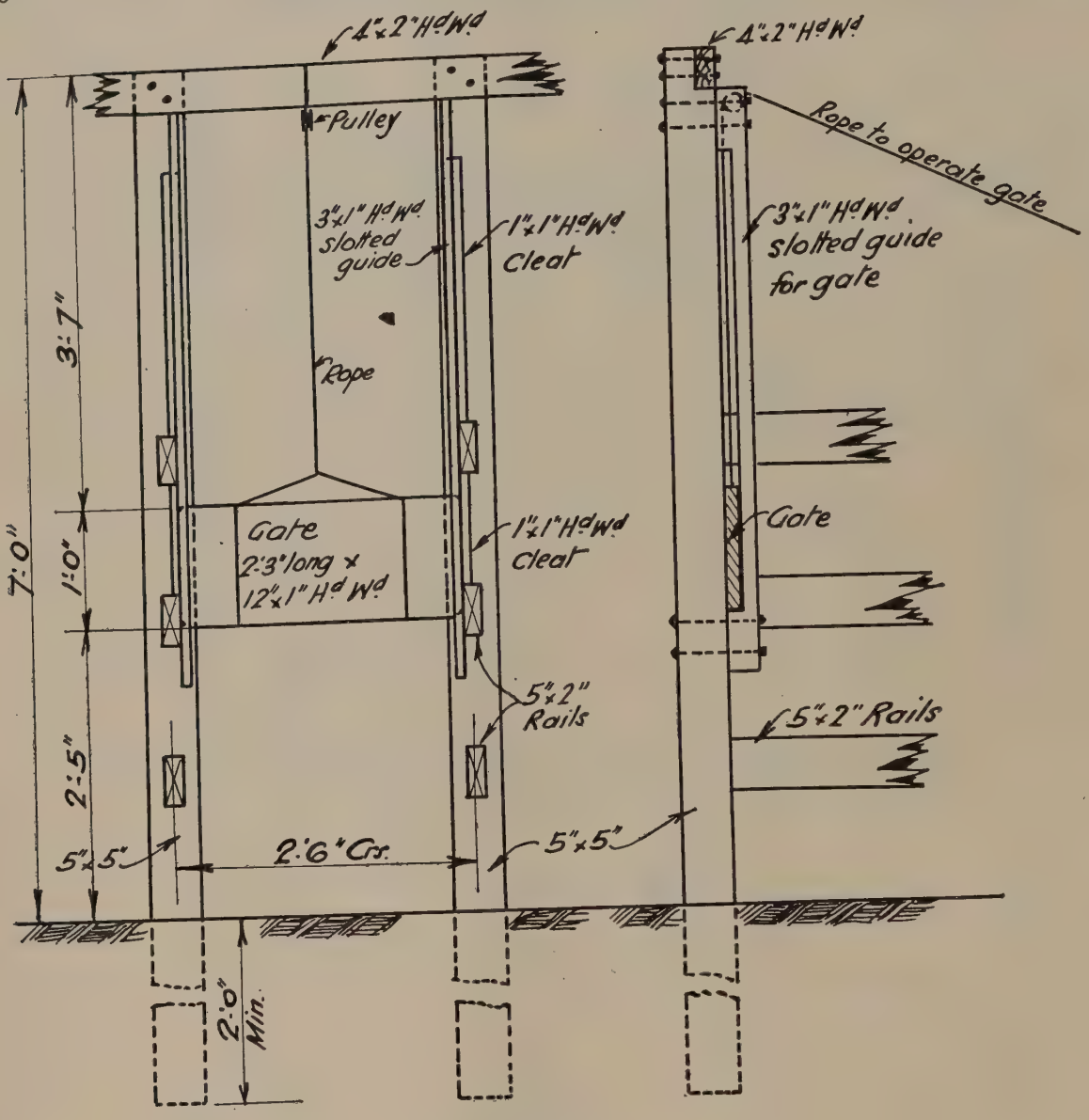


Plate 3.

Details of Gate.

trough. The rope has two loops tied in it to correspond with the two positions of the gate. The gate is placed on the inside of the stalls and held in position by a 3 x 1 slotted guide, with 1 x 1 hardwood cleats down each side to stop side sway. If desired, the sliding gates can be replaced by sword bails at the head of the stall.

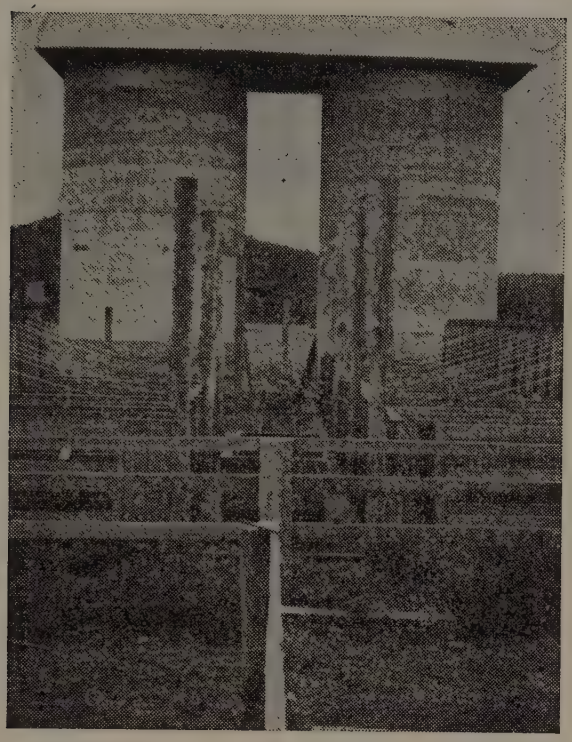
The feed trough has been designed for the feeding of silage or hay; it is divided at each stall, but this is optional. If desired, 4 ft. flat iron can be joined along the full length of the stalls and bent to the desired size. The bottom of the feed trough is set approximately 16 in. from the ground. The trough is 18 in. wide at the base and 25 in. at the top, and it has a depth of at least 11 in. at the front. It is an advantage if troughs can be easily removed for cleaning and repairing.

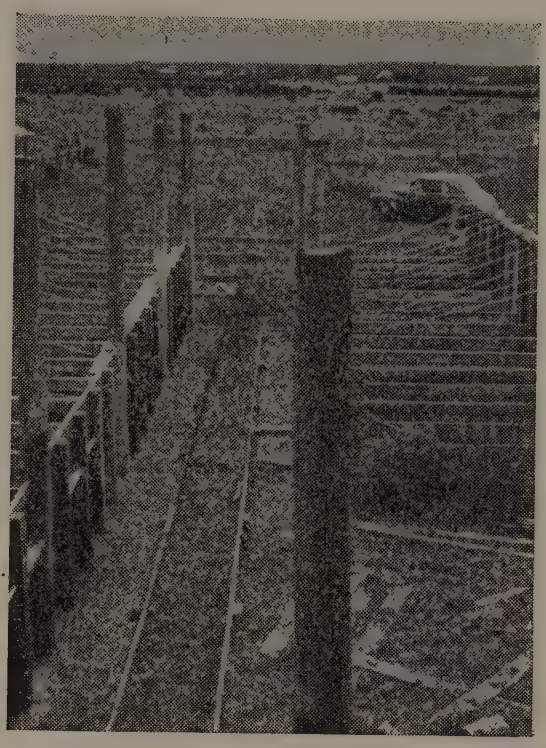
The plan is for sawn timber, but where costs can be decreased materially by using round timber, this may be done.

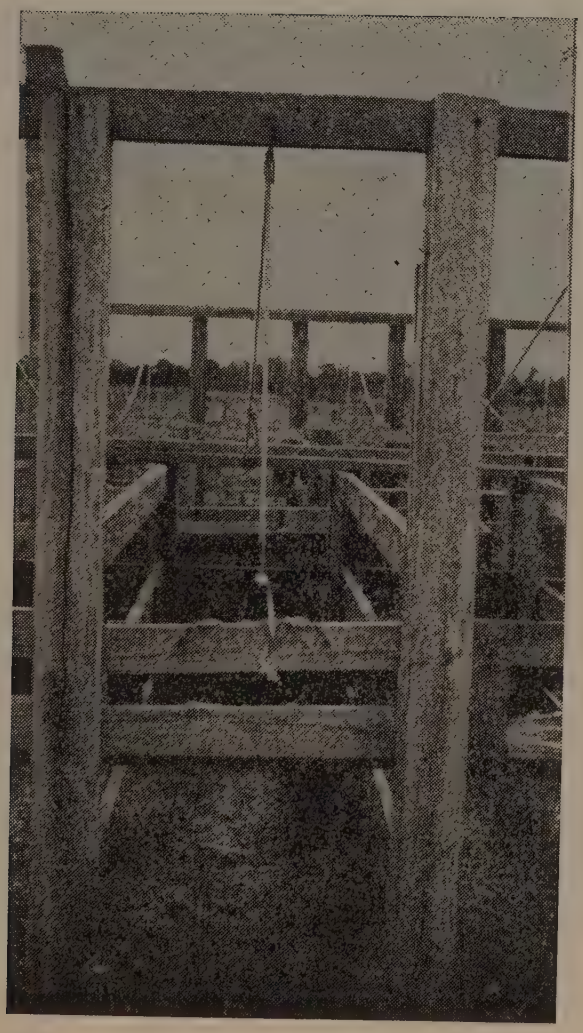
Site.

It is essential that a well-drained site be selected and that drainage be away from the bails and other out-buildings.

The stalls must be conveniently placed to allow ease of working of cows from the bails and surrounding paddocks. They must be placed next to the silo or hayshed and yet not hinder the process of storing silage or hay.







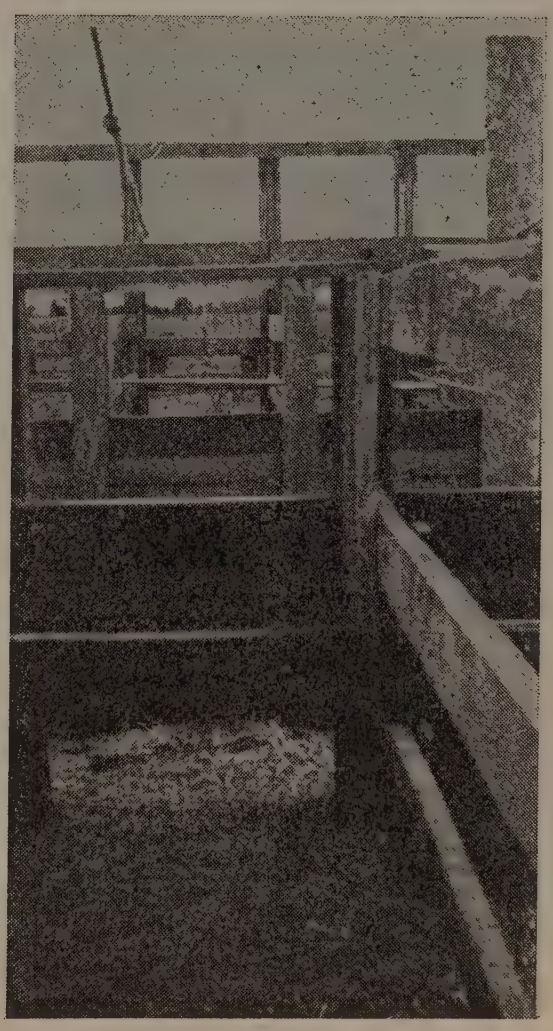
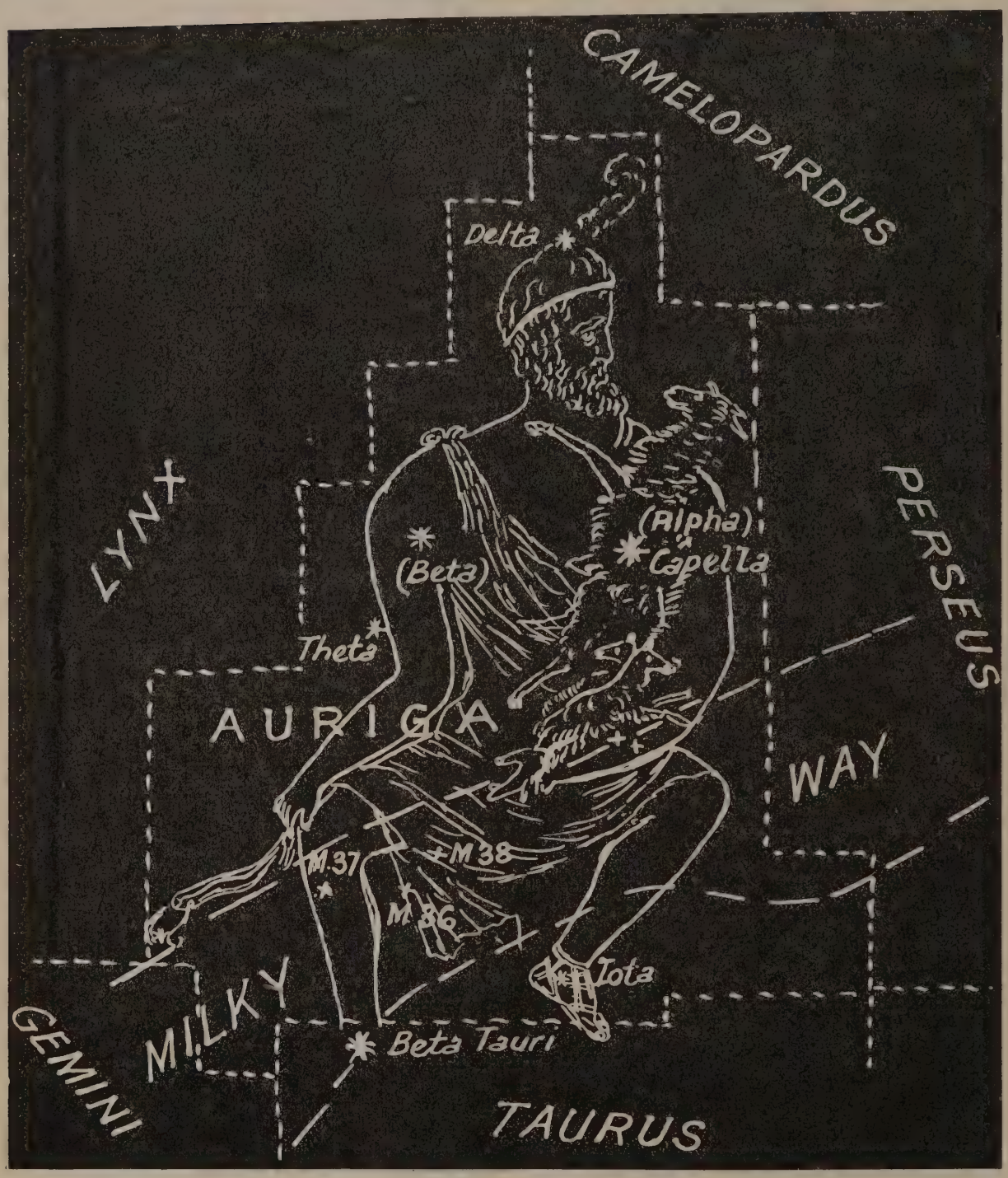


Plate 4.

Views of Stalls, Sliding Gate and Feed Trough.



THE CONSTELLATIONS.

AURIGA (THE CHARIOTEER.)

In mythology, Auriga was a charioteer, but for some unknown reason the ancient constellation figures picture him without a chariot, but holding a goat and three kids with his left arm and with a whip in his right hand.

The brightest star in the group is Capella (Alpha), which is a golden yellow in colour, but Ptolemy (A.D. 150), Al Fagani (10th century) and Riccoli all describe it as red. Possibly it may have changed its colour in comparatively recent times. Capella shows a spectrum similar to that of our sun, though it is much larger, having a mass about 5 times and a diameter about 9 times greater than the sun.

Auriga is situated between Orion and the north pole of the heavens, but in our case the horizon intervenes. The northern portion is just visible from Brisbane but may be seen more clearly from North Queensland. The constellation appears to us as a rough, irregular pentagon, with Alpha (Capella), Beta (Menkalinan), Theta, and Iota at four of the points and Beta Tauri at the apex. Directly north of Beta Tauri and about half-way between Theta and Iota are two fine, loose star clusters in the Milky Way (M36 and M38), while between Beta Tauri and Theta Aurigae is M37, another fine open cluster. Theta is a double with a 3rd and 7th magnitude, separated by 2.9 seconds of arc. Auriga is on the meridian about 8 p.m. towards the end of February.

CAMELOPARDUS.

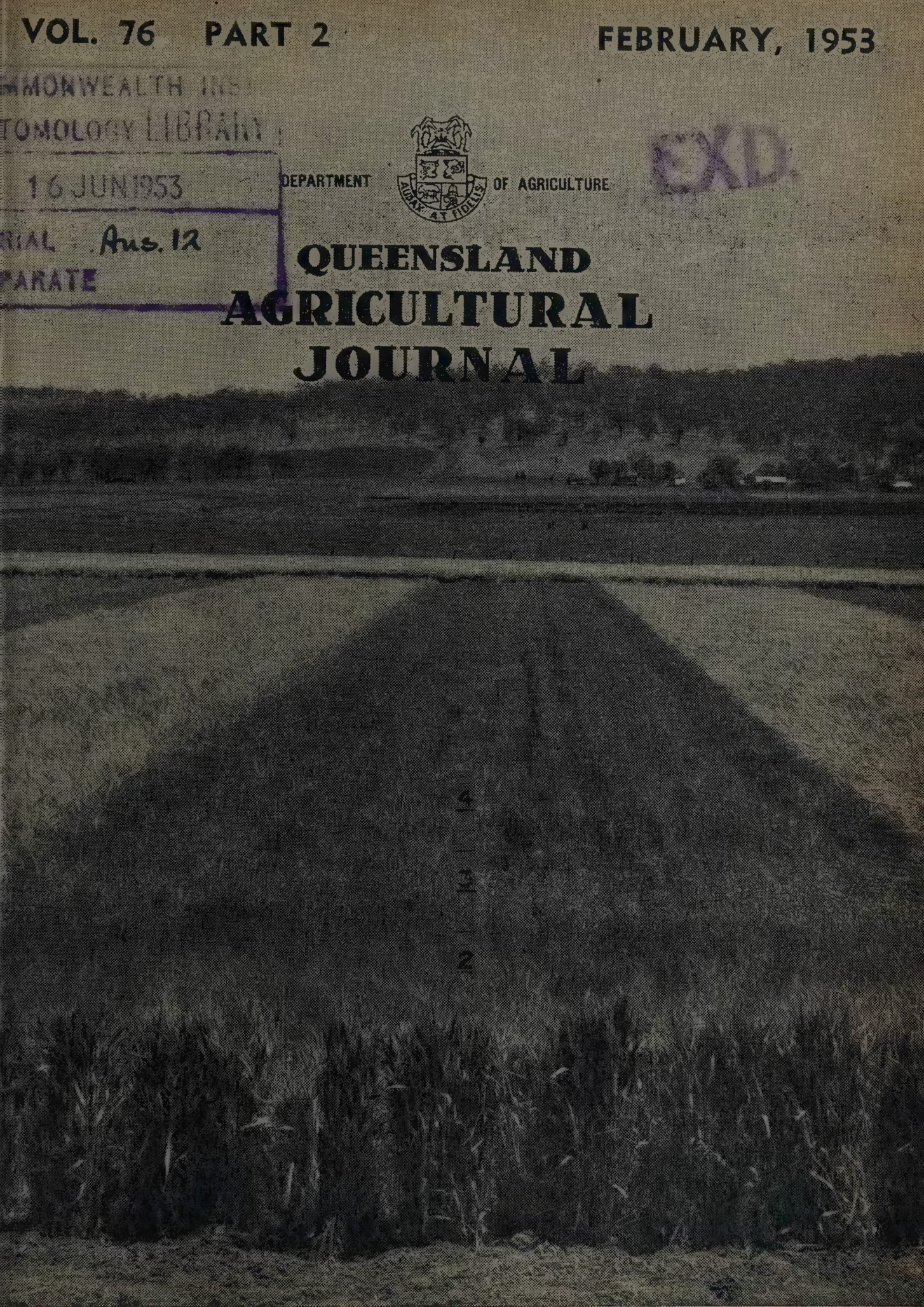
This is a modern constellation representing the giraffe and is situated between Auriga and the North Pole. It is not visible from southern Queensland, and though it may be seen from extreme North Queensland it is not a spectacular group, the brightest stars being only of 4th magnitude.

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Dairying in the North

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PLANT PROTECTION

Red Spider Mites and their Control.

A. R. BRIMBLECOMBE, Entomologist, Science Branch.

RED spiders occur in all countries of the world. They are really mites but the common name of red spider is derived from the red body colour of the adults and the fine webbing associated with their damage. Two species are of economic importance in Queensland. One* (Plate 1) is common in most vegetable and fruit-growing districts of the eastern part of the State, while the other† is known only from the south-eastern portion. A distinguishing feature between them is the more abundant webbing (Plate 2) associated with the less common species; otherwise their appearance, life histories and habits are similar and methods of control are the same.



Plate 1.

Red Spider. Magnified 100 times.

Host Plants.

These pests attack a very wide range of economic, ornamental, and weed plants, both native and introduced. The cultivated plants subject to severe damage include beans, cucumbers, strawberries, deciduous

* *Tetranychus urticae* Koch.

† *Eotetranychus telarius* (L.).

fruits, papaws, peas, melons, tomatoes, cotton, grape vines, gooseberries and tobacco. Specific control schedules for red spiders on deciduous fruits, tomatoes, cotton and tobacco are given in Departmental leaflets.

Nature of Damage.

Red spiders possess sharp, slender, lancet-like mouthparts which are used to pierce the surface cells of the host plants and to extract the plant juices. Normally they occur only on the under surface of the leaf, where the dotted whitish feeding punctures of a light infestation show as a pale suffusion. Heavy damage on such plants as beans, cucumbers and gooseberries is evidenced by a general pale mottling on the upper surface of the leaf (Plate 3). Similar damage on strawberries and cotton shows as an abnormal and irregular purple colour on the upper surface, usually adjacent to the main veins (Plate 4). In instances of severe damage the whole under-surface may assume a silvery colour, the leaf edges die, the plants generally look harsh, and growth becomes so retarded that the fruit ripens prematurely. Occasionally plants may even be killed.



Plate 2.

Red Spider Infestation of a Cape Gooseberry Shoot, Shown by Webbing and Mottling.

Life History.

The eggs are laid singly and irregularly amongst the webbing on the under surface of the leaf. These are spherical, pale, almost translucent, and barely noticeable to the naked eye. They hatch into 6-legged

larvae which after feeding moult progressively through two 8-legged nymphal stages to adults (Plate 1). The nymphal and adult stages have a similar oval shape without any noticeable division of the body into head, thorax and abdomen.

The larvae are inconspicuous in colour, which in the nymphal stages changes to pale yellow or pale green. The colour of the adults is mostly brick-red, but some individuals may be a dull yellow. This bright red colour against the green background of the host plant makes the mites easily noticeable to the naked eye.

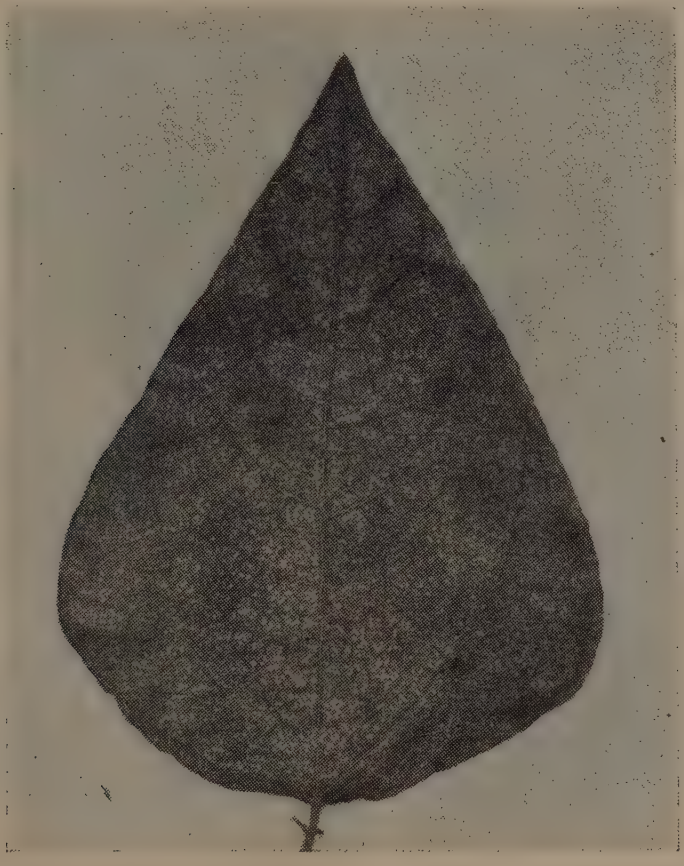


Plate 3.

Red Spider Damage to Bean Leaflet, Shown by Mottling on the Upper Surface.

Each female may lay 50 or more eggs during its life of from one to two weeks. These hatch in a few days, and during the summer the larval and nymphal stages may be completed in 7-10 days, giving an average life cycle of about two weeks. In the colder months the period is much longer, and depending on the severity of winter, 15-20 generations may be passed each year. Since the life cycle is brief, overlapping of generations is constantly occurring, and all stages of the mites are usually present on a leaf at the one time.

Habits.

Red spider mites prefer a concave surface and therefore they and their eggs usually occur against a vein on the under surface of the leaf. In this position they are well protected from wind and rain; the fine webbing adds to the protection. Feeding occurs mainly on the under surface and damage in the early stages may escape notice.

Dispersal of the mites is by wind, birds or transfer of plants, but most of the spread, though it is slow, is by the mites crawling from leaf to leaf and over the ground to other plants.

The red spider mites are nearly always present on most crops. The amount of damage, however, varies from farm to farm and in different districts, but usually the mites are well distributed throughout the one crop on any one farm. Furthermore, damage varies considerably on successive crops and also in successive seasons. Sudden changes in mite numbers may even be apparent from week to week. While this may be due to reproductive periods, actually climatic conditions have a much greater influence on breeding bursts or lulls than have previous populations.



Plate 4.

Red Spider Damage to Strawberry Leaf, Shown by Purple Discolouration Near Veins on the Upper Surface.

Least damage occurs during the winter months, when populations are low and activity is slight; also, at this time the pests are mainly on weeds and other wild hosts. Under Queensland conditions the mites are never completely dormant unless the winter is excessively cold, as may occur in the Stanthorpe district, and then only for short periods, since the warmth of fine winter days is sufficient to promote activity. It is chiefly the mature females which survive the winter, and weed hosts seem to favour survival better than cultivated crops.

With the return of warm spring weather the mites multiply rapidly until the winter food plants wane, and then they move onto early spring crops such as beans and cucumbers. If the dry weather of late winter continues into the spring, severe infestations can be expected and may extend into the summer. During the rainy season of late summer and autumn, damage is normally slight and is confined to periods of dry weather.

Hot, dry days increase egglaying, but chilly days, dewy nights or wet weather retard it and frequently prevent the development of mite epidemics. For this reason quickly grown irrigated plants normally escape damage until towards the end of the crop, or if watering is eased during harvesting. Non-irrigated crops may suffer severe damage, particularly during periods of low rainfall.

Control.

Red spider mites have several natural enemies, the chief one being a tiny ladybird*. This insect normally assists in checking the pests but is not effective when conditions favour rapid mite breeding.

When chemical control measures become necessary, several well-tried and effective insecticides are available. Because the mites extract the plant juices as food, the chemicals used must kill by contact, and since the pests occur mainly on the under surface of the leaf it is essential for that surface to be treated thoroughly. One application of insecticide does not give a complete control and repeated applications are advisable, the number being determined by regular observations. Failures in mite control are not always due to the chemical; the thoroughness of the applications is important. The choice of the insecticide depends on the crop or the season and no one insecticide is ideal for all conditions.

Suitable readily available dusts and sprays are as follows†.

Dusts.

(1) Dusting sulphur.
(2) Nicotine sulphate dust.
(3) Parathion dust (not exceeding 0·15% active ingredient.

} Applied at the rate of 10-20 lb. per acre depending on the size of the plants.

Sprays.

Stock.	Dilution.	Per 10 gallons.	Per 3 gallons.
(1) Wettable sulphur	As given on labels of proprietary lines.		
(2) Lime sulphur	1 part in 80	1 pint	6 fl. oz.
(3) Nicotine sulphate	1 part in 640	2½ fl. oz.	¾ fl. oz.
(4) Parathion or E.605	As given on labels of proprietary lines.		
(5) HETP	1 part in 800	2 fl. oz.	approx. ½ fl. oz.

Dusts are best applied in fine, cool weather, particularly in the morning when the air is comparatively still. For some crops, such as tomatoes, mixed dusts containing sulphur are regularly used and in these the sulphur content should not be less than 30%. The separate leaflet on insect pest of tomatoes should be consulted. On other plants, such as strawberries, where red spider alone is to be controlled, the sulphur may be diluted with equal parts of hydrated lime. Sulphur dusts applied to the growing points of young cucurbit plants can seriously retard growth, and can cause leaf burn on other plants when used in hot weather.

* *Stethorus vagans* (Blackb.).

† The more promising of the newer miticides are still under test.

Sprays are commonly used for mite control, but in some instances dusts may be more convenient and more effective. On low-growing plants such as strawberries there is a good rebound of dust from the ground onto the lower leaf surface, and on thickly foliaged plants dusts give a fogging effect. However, by using sprays only one type of apparatus is required and stock solutions can be held more conveniently than dusts. Also, most farms now have a readily available water supply.

Warning.

A health risk is involved if parathion or E.605 is inhaled or absorbed through the skin. Care should be taken to avoid inhaling this insecticide or being unduly wet by spray. Splashes of the concentrate should be washed off immediately with soap and water and any clothes which are splashed should be changed immediately and not worn again until they have been washed.

Citrus Virus Diseases in Queensland.

B. L. OXENHAM and O. W. STURGESS, Assistant Pathologists, Science Branch.

THE presence of a complex of virus diseases affecting Queensland citrus has been recognised only in recent years. Growth "declines" in trees of certain varieties, or of particular stock-scion combinations, have been observed over a long period, but in most instances the cause has been obscure. However, investigations carried out in various countries during the last few years have provided information which has established the virus origin of a number of these obscure diseases.

It is hoped that the following information will assist citrus growers in the recognition of trees affected with virus diseases and influence them in the choice of varieties and rootstocks when making new plantings.

STEM PITTING OF GRAPEFRUIT.

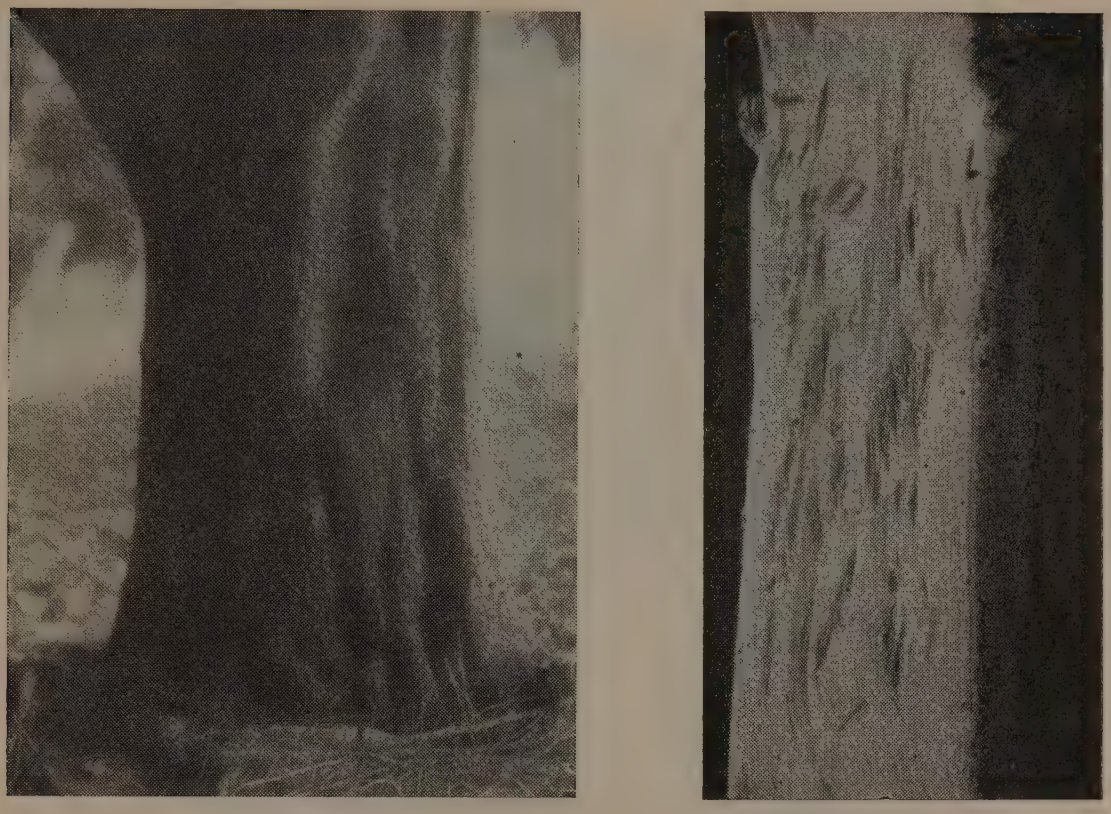
Stem pitting of grapefruit is the most serious virus problem affecting the Queensland citrus industry. The disease has been known in Queensland for many years as "grapefruit decline" but until recently the cause was uncertain.

In a survey of the Gayndah-Mundubbera area in 1951, every mature planting of Marsh's Seedless grapefruit inspected was found to contain infected trees. Most plantings had become unproductive by the fifteenth year and some trees were showing advanced symptoms as early as three years of age.

Symptoms.

The most obvious symptoms are observed on trees which have been infected for many years. The name of the disease, stem pitting, is derived from the pit-like depressions or concavities which develop in the surface of the trunk and larger branches (Plate 1, a).

In conjunction with the stem pitting, the tree takes on an irregular or "crazy top" appearance. This malformation is brought about by irregular flushes of weak growth, and the tree may eventually assume a bushy habit. Fruit on infected trees are small and lopsided, have a thick rind and are of little or no commercial value.



a b

Plate 1.

Stem Pitting of Grapefruit.

(a) A 13-year-old Marsh's Seedless grapefruit on rough lemon stock. Note the dimples or concavities in the trunk. (b) Exposed grapefruit wood revealing the pitted striations due to the stem pitting virus.

Evidence of the disease in young plantings is more difficult to detect. Early symptoms may be found by stripping the bark from small branches to expose the abnormal pitted striations or grooves which follow the grain of the wood (Plate 1, b).

Transmission.

The virus is transmitted by budding or by the black citrus aphid (*Aphis citricidus* (Kirk.)), which is abundant in citrus orchards.

PSOROSIS OR SCALY BARK.

Psorosis was first recorded in Queensland in 1927 and since then has been reported from all the major citrus districts in the State. In 1949 a psorosis survey of a representative number of orchards in the chief citrus areas was made. Washington Navel and Joppa oranges and Beauty of Glen Retreat and Emperor mandarins were found to be the most severely affected. Late Valencia orange seems to be the least affected by the disease and rarely shows advanced symptoms. In some cases, aged trees of various varieties have been seen to crop well despite the presence of acute symptoms of psorosis.

Symptoms.

Symptoms usually appear on infected trees between 10 and 30 years of age, and are of several distinct types.

Scaly Bark.—This is the most severe and also the most easily detected symptom. In advanced cases, large areas of bark may scale off the trunk and limbs of the tree, and sometimes complete girdling results. Badly affected trees are sparsely foliaged and show dieback of the twigs and branches.

With less acute cases of "scaly bark," small areas of raised bark may be found, commencing as an odd pustule of lifted bark (Plate 2). An area of scaling is often found in the crutch of affected trees, and chains of pustules may extend along the limbs.



Plate 2.

Psorosis or Scaly Bark. A stage of psorosis on Emperor of Canton mandarin. The affected branch shows raised areas of bark scaling.

Pimpling.—This condition of the bark, found on branches and even twigs, is the most common symptom encountered. The "pimples" consist of small raised pustules, about an eighth of an inch in diameter, on top of which the bark lifts in a tiny lid. A number of these may coalesce to form a small scaly area (Plate 3). Pimpling is usually prominent on trees showing scaly-bark lesions, but is commonly seen before scaling occurs.

Leaf Stippling.—Leaf symptoms of psorosis have been reported elsewhere but have rarely been observed in Queensland. A "stippling" of the young leaves, consisting of a clearing and mottling between the veins, has been described, the clearing sometimes taking the form of an "oak leaf" pattern.

No fruit symptoms which can be attributed to psorosis have been observed in this State.

Transmission.

The use of virus-infected budwood has been accepted as the main method of psorosis transmission.

The presence of psorosis in seedling trees in North Queensland orchards, however, seems to suggest some other means of transmission previously not taken into consideration. If seed transmission may be discounted, it is possible there is an insect vector.

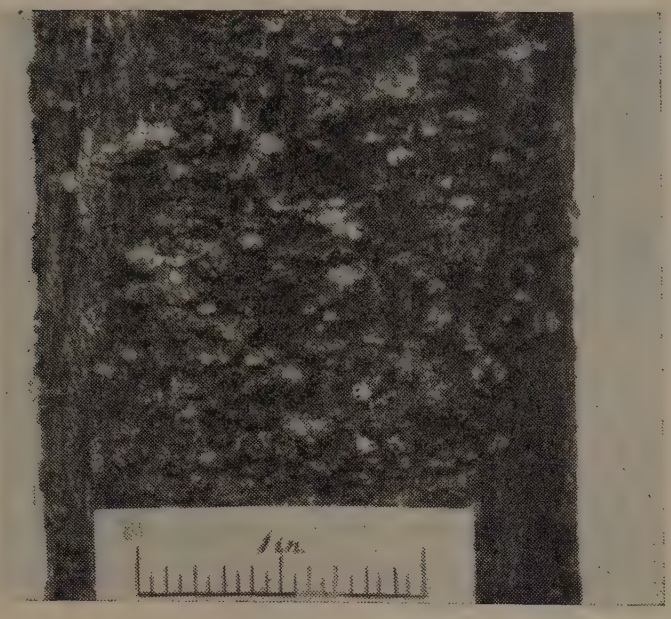


Plate 3.

Psorosis or Scaly Bark. Emperor of Canton mandarin showing how numerous small bark pimples have coalesced to form a scaling area.

BUD UNION DECLINE.

The name "bud union decline" is synonymous with "quick decline" in California, "tristeza" in South America and "incompatibility" in South Africa. This virus is carried in the scion and exerts its effect on susceptible rootstocks. All varieties of citrus budded onto sour orange or Seville rootstocks are liable to decline. Overseas investigations have shown that grapefruit rootstock may also be susceptible to the bud union decline virus, and on the basis of present evidence grapefruit should be avoided as a stock for sweet-orange and mandarin.

There are conflicting reports as to the tolerance of rough lemon, but although this rootstock has been almost universally used in Queensland, so far the presence of bud union decline in trees on this stock has not been recorded.

Sour orange has not been used as a rootstock to any extent in this State and therefore bud union decline as yet does not present any problems.

Symptoms.

Infected trees on susceptible rootstocks, such as sour orange, may show symptoms from the second year of growth. The general appearance of an affected tree is similar to that caused by girdling. The first noticeable symptom is a dull ashen colour in the terminal foliage with a curling of the leaves lengthwise and upwards. In chronic cases the leaves may gradually drop, but in acute cases of collapse they suddenly wilt and dry on the tree.

Transmission.

Like the stem pitting virus of grapefruit, the virus is transmitted by either budding or the black citrus aphid.

SCALY BUTT OF TRIFOLIATA.

The species *Poncirus trifoliata* has proved to be a desirable citrus rootstock, but unfortunately its use has been restricted by the incidence of the scaly butt virus. This virus, which is carried in the scion without

direct ill-effect, expresses its symptoms in the trifoliata rootstock and thereby results in subsequent stunting of the scion. The incidence varies according to the scion variety and the source of the budwood used.

Scaly butt invariably occurs when lemon is used as the scion, but it appears to be of less consequence in the case of Late Valencia orange and most mandarin varieties. Results vary in the case of Washington Naval orange and grapefruit, scaly butt incidence depending on the source of the budwood, as only certain trees of these varieties carry the virus.

Symptoms.

Affected trees usually show early symptoms between the fourth and eighth year from budding. The symptoms are typified by scaling of the outer bark of the trifoliata stock and retardation of growth of the scion (Plate 4). New scales are produced irregularly beneath the older bark lesions, and as scaling progresses the affected surface cracks, with scaled tissue lifting away from the living bark.



Plate 4.

Scaly Butt of Trifoliata. Union of a 4-year-old stunted Villa Franca lemon on trifoliata stock, showing scaly butt symptoms below the bud union.

Affected trees remain small and stunted, and in severe cases mature trees may only reach four to five feet in height. The stock rarely outgrows the scion, whereas in mature, healthy trees the trifoliata stock may be several times greater in diameter than the scion, and is deeply-ribbed.

Transmission.

The disease is transmitted by propagating with buds taken from virus-affected mother trees. It is interesting to note, however, that not all buds taken from affected trees appear to transmit the virus.

There is no evidence of field spread, and it is also assumed that seedling trifoliata stocks are entirely free from the virus, on the evidence that no seedling tree has been found showing scaling symptoms.

MANDARIN DECLINE.

A slow decline of Ellendale Beauty mandarins on rough lemon stock has been evident in Queensland for some years. Recent investigations indicate a virus infection as being responsible for the decline. The identity of the virus and its relationship to other viruses in the citrus virus complex have not been determined. Other mandarin varieties, such as Beauty of Glen Retreat and Emperor of Canton on rough lemon, are suspected of a similar decline. Symptoms of decline in each of the mandarin varieties bear marked similarities.

The same strains of mandarin budwood when worked on stocks other than rough lemon make normal growth.

Symptoms.

Affected trees take on a rounded, squat appearance as a result of their sparse, short-wooded manner of growth, and suffer considerable twig dieback (Plate 5). A bright yellowing of the leaves, commencing as a yellowing of the veins, is a prominent feature and such leaves show a downward curling of the tip.

Declining trees produce light crops and the fruit is slightly irregular in shape with a coarse rind.

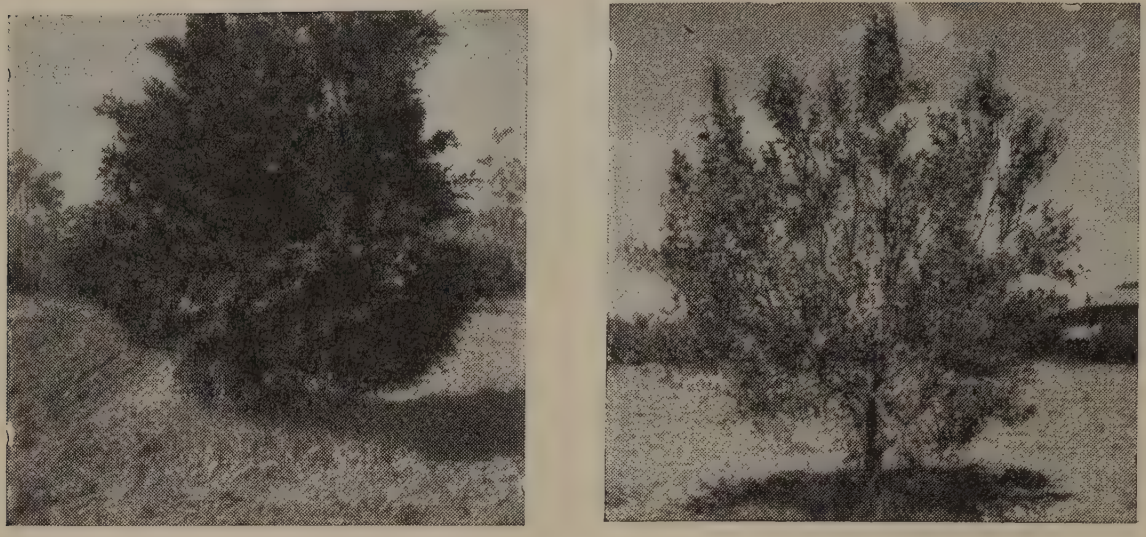


Plate 5.

Mandarin Decline. Effect of the mandarin decline virus in budwood collected from the same source when propagated on different rootstocks. Left, a productive Ellendale Beauty mandarin on sweet orange stock. Right, an unthrifty Ellendale Beauty mandarin on rough lemon stock showing considerable twig dieback.

Transmission.

The mandarin decline virus is transmitted by budding. Therefore, it seems at present inadvisable to propagate mandarin varieties on rough lemon stock until more information is obtained as to the presence of the virus in budwood sources. Other rootstocks such as sweet orange and Emperor mandarin have given satisfactory results when worked with Ellendale Beauty and Beauty of Glen Retreat buds (Plates 5 and 6).



a b

Plate 6.

Mandarin Decline. Beauty of Glen Retreat mandarins (4-year-old) grown in the same orchard. (a) On sweet orange stock, normal growth. (b) On rough lemon stock, unthrifty growth characteristic of the mandarin decline virus.

SHELLBARK OF LEMONS.

Up to the present the nature of lemon shellbark has not been conclusively determined, although a number of research workers have suggested that the disease is caused by a virus. Fungi are apparently not responsible for the initial incidence of the disease but commonly produce secondary complications. Shellbark is found associated with lemon trees of considerable age, the onset of symptoms varying from 18 to 25 years or more.

Symptoms.

Shellbark is a disease affecting the outer layers of bark on the trunk. Prior to bark shelling, affected trees lack vigour, the foliage becomes chlorotic, and leaf shedding and twig dieback occur. The outer bark of the trunk dies and cracks, with the condition advancing from the bud union upwards until the entire trunk is involved (Plate 7). The inner bark and cambium remain alive and build up new layers to replace the outer destroyed areas. The development of new bark causes the dead bark to shell off in vertical strips. Shellbark is chiefly confined to the trunk, rarely extending along the main branches.

The disease is rarely fatal and has the unusual feature that following a period of bark shelling the tree as a whole may temporarily recover until the next outbreak occurs.

It is inadvisable to treat affected trees as for collar rots. Scraping and painting of shell-barked areas damages the cambium and developing bark, and hinders recovery.

GENERAL RECOMMENDATIONS.

There is no known method of eliminating viruses from a citrus tree after it has become infected, hence their control largely rests on the use of virus-free budwood, or in the case of virus diseases involving certain stock-scion combinations, the selection of suitable tolerant rootstocks is the solution. It is possible also that, when more is known of these



Plate 7.

Shellbark of Lemon. Affected trunks of Villa Franca lemons on rough lemon (16-year-old).

diseases, use may be made of budwood carrying mild, protective strains of the viruses, or that strains of citrus may be detected which are tolerant to virus infection.

With a view to avoiding citrus virus diseases or reducing their severity, the following recommendations are tentatively made.

(1) *Stem Pitting of Grapefruit.*—Use budwood which is virus-free, or which carries a mild strain of the virus without any ill-effects to the mother tree.

(2) *Psorosis.*—Use virus-free budwood.

(3) *Bud Union Decline.*—Avoid sour orange as a rootstock, and also grapefruit until further information is available.

(4) *Scaly Butt of Trifoliata.*—Do not bud lemon varieties onto trifoliata rootstocks, and use only strains of Washington Navel orange and grapefruit which are free of the virus.

(5) *Mandarin Decline.*—Avoid rough lemon as a rootstock for Ellendale Beauty mandarin, and also treat it with suspicion as a rootstock for other mandarin varieties pending further investigations.

(6) *Shellbark of Lemons.*—Avoid surgical treatment of affected trees and allow them to make temporary natural recovery.



Beef Production in Association with Cultivated Crops.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

BEEF cattle are able to convert fibrous plant fodders of relatively poor quality into meat. They have been developed to make optimum use of the less nutritious pasture species. In the main, the future development of the beef industry in Queensland depends on more efficient use of natural summer-growing pastures for the growth and fattening of beef cattle.

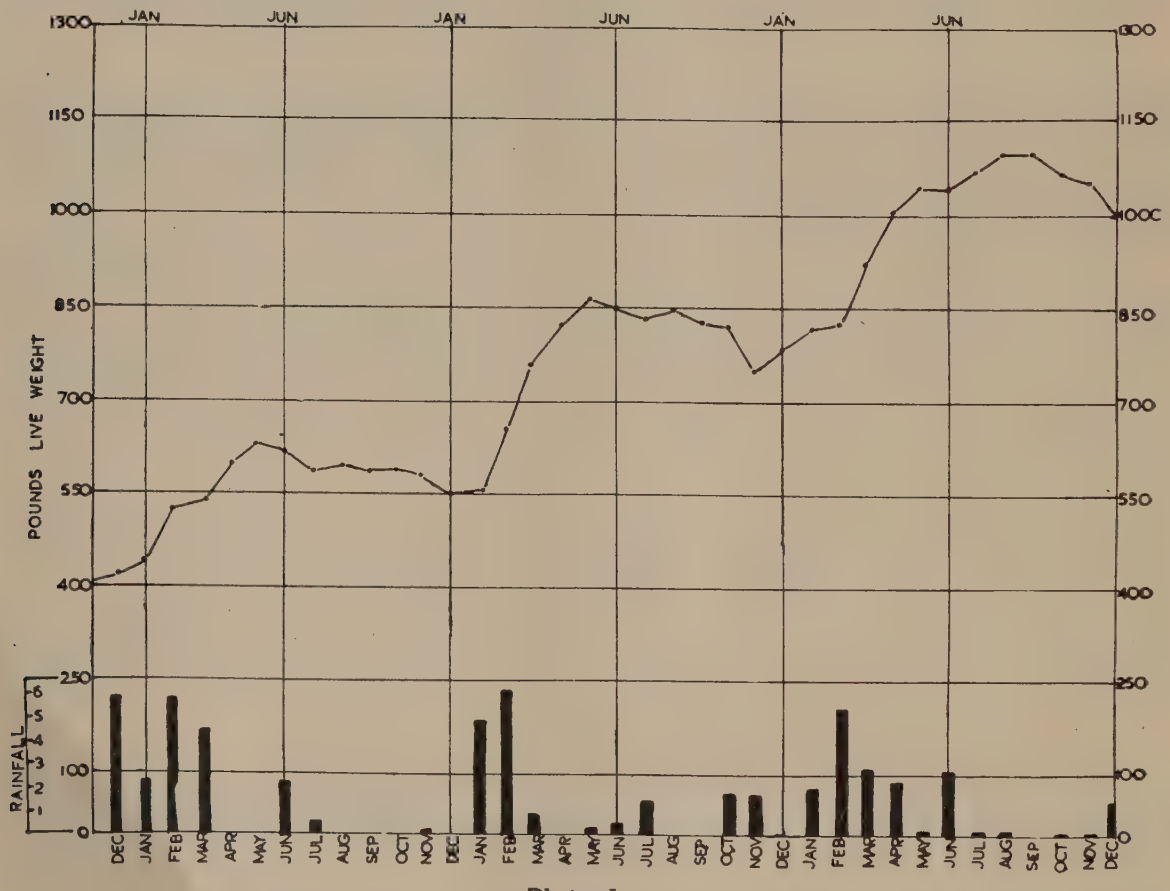


Plate 1.

Graph Illustrating the Normal Growth Pattern of Beef Steers on Natural Pasture in Queensland.

Normally in Queensland the beef steer gains weight during the late spring, summer and autumn months but loses weight during winter and early spring (Plate 1). Thus, there is a wastage during winter and early spring of pasture eaten in summer and autumn. It has been said that "a beef steer losing weight is being fed on beef steak," and beef steak is a very expensive type of food for cattle.

Loss of weight and the resultant waste of natural pasture may be avoided by giving the steer access to some supplementary form of fodder during periods when pasture does not provide a maintenance diet. For best economic returns this fodder should be used as a true supplement rather than a substitute for pasture.

Queensland is not alone in having this problem of seasonal loss of weight to overcome. Other major beef-raising countries have a similar problem, but Queensland has been one of the last important cattle areas of the world to realise that, for optimum growth and fattening, beef cattle must be provided with something more than what they can forage from pasture under natural conditions.

CROP GRAZING.

One of the most effective methods of supplementing pastures is by crop grazing. Using this method, high-quality beef can be produced and made available to the market at a time when pasture-fattened cattle are unavailable.

Under present conditions in Queensland, a flush of cattle is available for slaughter during autumn and the early winter months, but at other times of the year fat cattle are frequently unavailable in sufficient numbers to meet local demands. The pattern of supply is shown in Plate 2.

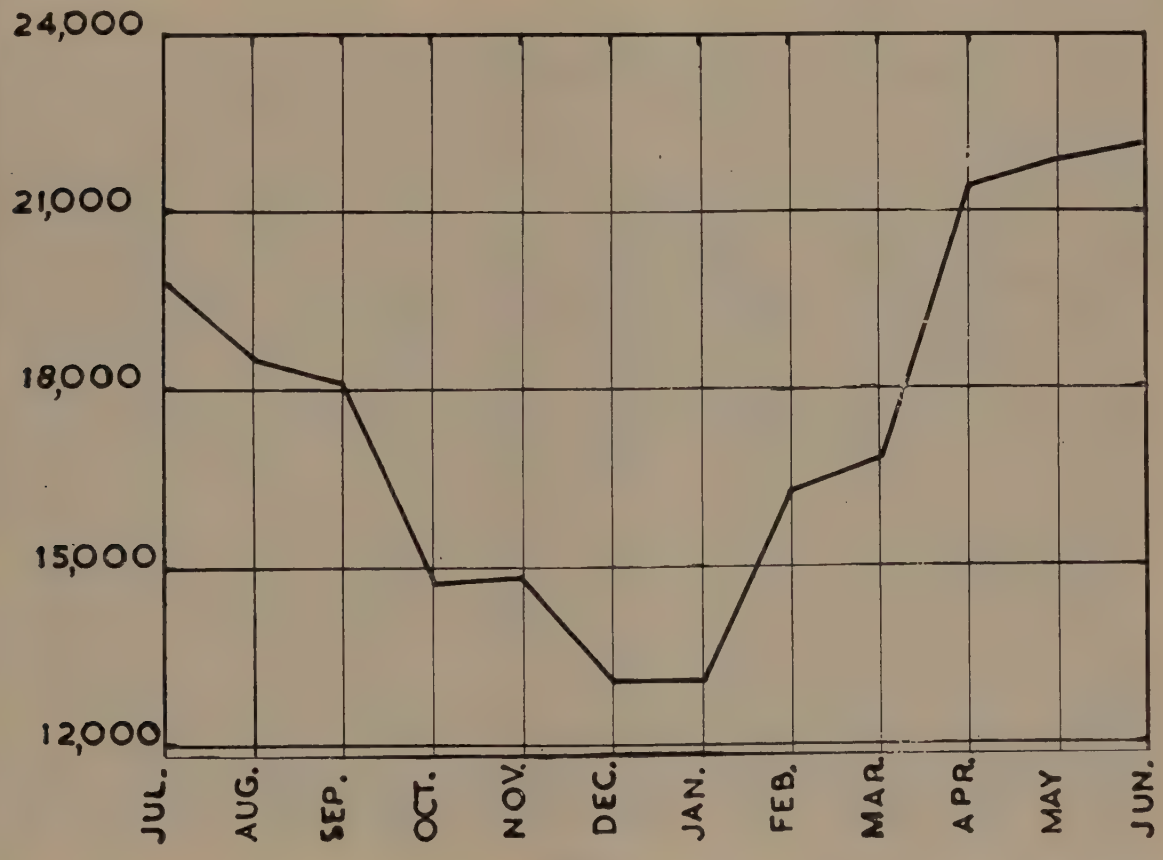


Plate 2.

Average Monthly Slaughterings of Cattle at the Brisbane Abattoir for the 5-Year Period July 1946 to June 1951.

In some areas of the State the best natural grasses have been eaten out by overgrazing and replaced by less palatable and nutritious species: consequently in these areas stock do not thrive so well as previously and the carrying capacity of much country has been considerably reduced.

A rotational programme of pasture and cultivated crops coupled with the use of grazing animals can increase the carrying capacity of land without loss of soil fertility. Farming is rapidly becoming a normal practice on grazing properties in the more reliable rainfall districts of the State, and the cattleman of tomorrow may be as familiar with the tractor as he is with the stock horse.

AREAS WHERE CROP GRAZING MAY BE PROFITABLE.

Until a few years ago, crop grazing for beef production was confined to the Darling Downs and the south-eastern corner of Queensland. Lately, however, there has been a gradual spread west and north from this area and quite recently the practice has spread into Central Queensland, particularly the black-soil areas of the Central Highlands.

There is little doubt that in all areas extending south from a line from Clermont to Mackay and experiencing an average annual rainfall of 25 inches or more, crop grazing will continue to increase in importance. North of this line, the future of agriculture in beef production is not so certain, but at the worst it has possibilities. The development of suitable varieties of sorghum and other crops and the availability of suitable farm machinery could convert this area from a purely grazing one to one in which small areas of agriculture for the production of fodder for fattening and the maintenance of stud breeding herds would be common.

TYPES OF CROPS USED FOR GRAZING.

In southern Queensland, the most popular crop used for winter grazing by beef cattle has been oats, but wheat and barley and canary-seed grass are also used. Sudan grass, sweet sorghums, millets and lucerne are the principal crops used for summer grazing. Sudan grass provides early spring feed, while the grazing period of sorghums can be extended from early summer until well into the winter by planting at proper intervals.

Cereals can be grazed as soon as the plants have sufficient root development to withstand pulling. If the crop is very succulent, stock tend to scour badly, especially when first put on it. Access to roughage, such as dry grass, stubble, mature sorghum or hay, helps to control the scouring.

Caution must be exercised in grazing sorghums during the early stages of growth owing to the possibility of poisoning. However, the crop fattener can generally afford to wait until the sorghums mature, as during the period of active growth of these crops good pasture is usually available. Crop supplementation at such times is unnecessary and indeed uneconomical. A decided advantage of the sweet sorghums is that they stand well for some time in the paddock after maturing without any serious loss of food value. Thus they can be held until the nutritional value of pastures has deteriorated to the point where supplementation becomes of value in maintaining growth and fattening rates of cattle. Under certain seasonal conditions the sorghums will



Plate 3.

Harvesting a Young Sorghum Crop for Hay on the Darling Downs. Such crops are frequently used for grazing.



Plate 4.

A Paddock of Sorghum Stubble Provided with a Natural Windbreak Makes Ideal Winter Quarters. Cattle thrive under these conditions.

frequently supply high-quality fodder well into the spring months. The yield per acre of fodder from sorghum crops is, in addition, very considerable.

The stubble of harvested grain sorghum is also used commonly. In the more northerly areas of the Upper Burnett and in Central Queensland the growing season of winter cereals is shorter and the amount of feed available from such crops decreases: under these conditions the importance of sorghums increases.

On the Darling Downs in good seasons, oats may be available for grazing from May to October; during this time, with short rest periods, up to one beast to the acre may be carried. On the other hand, in bad years there may be no more than one or two months of grazing available, and that of indifferent quality.

Lucerne is also used as a grazing crop for beef cattle in southern Queensland, but it has not been as popular for this purpose as in other parts of Australia or overseas and at the moment is not used to any considerable extent. There would appear to be difficulty in maintaining suitable stands of lucerne in some areas where crop grazing has become popular, although row cultivation shows some promise of giving good results in the drier areas. The crop also presents some risk of death from bloat, and in most cases fails to provide sufficient feed for intensive grazing during winter and early spring months, when it is most needed under Queensland conditions.



Plate 5.

Stooked Wheaten Hay on the Darling Downs. This crop was cut 80 days from planting.

SOME ADVANTAGES OF CROP GRAZING.

Where agriculture is practised, grazing cattle offers a convenient means by which crops can be marketed and often utilises growth which cannot be converted into cash by any other means. Where weed growth has become a problem in paddocks used for grain production, a rotation from grain to grazing crop frequently provides an effective and profitable method of weed control.

The adoption of cash-crop farming methods on a non-rotational basis, as is frequently practised in Queensland, may in time lead to deterioration in soil fertility and soil structure. The introduction of grazing cattle into a crop-rotation programme can do much to arrest that deterioration and for this reason cattle should have a place in all farming programmes in Queensland.

In areas where land is very cheap, the utilisation of condition gained by cattle on grass during the flush season for maintenance during the dry season may be profitable, but in areas where land is of high value, continuous growth is essential for best economic returns. Cultivation by conserving moisture and growing crops of high nutritive value makes available good grazing at periods of the year when natural pasture is of low nutritive value, thus extending the period when grazing of high quality is available to the growing and fattening animal. This in turn has the effect of extending the killing season for prime cattle as well as permitting their slaughter at an earlier age. More rapid turnover ensues, thus increasing returns per acre.

TYPES OF CATTLE TO BE GRAZED.

Most people think of crops as being used only for the fattening of forward store bullocks. Whilst this may be the most important use of crops in Queensland at the present time, they have a much wider application, as is indicated below.

Calving Cows.

If cows calve in poor condition on poor pasture, the calf is smaller at birth than would otherwise be the case, and its growth rate during the suckling period is retarded. In severe cases the calf frequently dies, and if the cow survives she is not in a condition to continue a



Plate 6.
Cows on Poor Feed Cannot Rear Good Calves.

normal breeding programme in the following season. It has been shown that birth weight and weaning weight of calves are closely correlated with growth rates later in life. The calf which is undersized at birth or weaning usually grows more slowly after weaning than a calf of normal weight at these times.

An area of cultivation not only does much to ensure the survival of both dam and calf, but makes normal birth weights of calves and rapid growth during the suckling period much more likely. The cow is also well prepared for her next breeding season. It is a mistake to believe that poor-quality country is satisfactory for breeding cows. The nutritional demands of the cow are greatest at calving and during the months of milk production; if she is maintained on a sub-maintenance diet at this period the growth rate of her calf will suffer.

The use of crops for grazing cows and calves is probably only profitable in areas where cattle can be marketed at an early age. In some cases the calves may be sold whilst still on the mother (at 6-9 months old), or they may be carried through on pasture and finished off as chiller-quality steers on crop in the following year.

If an expensive crop is used to grow calves, it is important that a rapid growth rate be maintained until slaughter.

Weaners.

Under natural grazing conditions in Queensland it is normal for beef calves to lose weight at weaning time. Frequently this loss of condition is considerable and growth is retarded for from six to 12 months. Calves weaned onto a suitable grazing crop continue to gain weight and frequently can be marketed as veal at from 10 to 12 months of age. On the other hand, should it be intended to carry them through to the chiller-grade stage, crops can be used to maintain growth until pastures are of sufficiently high quality.

Store Cattle.

Crops are used most commonly in Queensland for fattening steers. The ideal type of steer to fatten is a beast from 18 months to two years of age, but there is frequently some difficulty in obtaining cattle of this age in sufficiently forward condition to place on crop, and more frequently cattle of from $2\frac{1}{2}$ to $3\frac{1}{2}$ years of age are used. Cattle older than $3\frac{1}{2}$ years are seldom satisfactory for crop fattening, as unless they are well bred and have been maintained on better than average pasture they will not, even when in prime condition, produce the type of carcase likely to command a premium price in the saleyard. Generally, the younger the cattle the better the use they will make of the fodder available.

As the nutrients of natural pasture are rapidly lost following the onset of dry weather or winter, it is not uncommon for cattlemen to have a number of unfinished cattle on hand at such times. These cattle have either to be sacrificed on a market over-supplied with unfinished beef or else held until the next season. During this holding period there is a loss of weight which has to be made good in the following season before the fattening process commences again. The amount of beef lost in this way in Queensland is huge and would be greatly in excess of the State's present exportable surplus.



Plate 7.

There is no Check in Growth When Grazing Such as this Oat Crop is Provided for Weaners.



Plate 8.

Rising Ground With Shade and Shelter Makes an Ideal Camp in Wet Weather.

Topping-off unfinished cattle on crops may be quite an economic proposition, for even if the extra weight of beef produced is insufficient to offset the cost of the crop, there is the added return which results from the fact that in winter and spring in Queensland the value of prime steers is nearly always greater than the value of store cattle per 100 lb. Therefore not only the extra weight of beef is to be considered but also the extra price per pound of the whole carcase. Due regard must also be given to the weight loss avoided by not having to hold the cattle on poor pasture until the following season.

Crop fattening by the small mixed farmer is a more difficult and risky undertaking than is crop fattening by the grazier. In order to be reasonably assured of profitable returns, the crop fattener must be in a position to purchase suitable stores at reasonable prices and he must be able to hold the cattle until the crop is ready to be grazed. It is considered that for most efficient operation of a crop-grazing property the cattleman requires five acres of grassland for each acre of crop. If he is in this position, stores can be purchased when they are most readily available and held on the property. If stores must be purchased only when the crop is ready for grazing, there is considerable competition for suitable cattle, which means that prices are high and there is a possibility that cattle will not be available at all. The fattener may quite conceivably be left with a crop and no cattle to graze it. If the crop fails to carry the cattle to prime condition and no grass is available to hold them pending the recovery of the crop, the cattle must then be sacrificed at the best available price.

Culled Dairy Cows and Calves.

Large-framed cows of the dairy breeds or beef cows with good milk production mated to beef bulls of quick-maturing strains, when depastured on crops, are capable of rearing calves of 350-400 lb. dressed



Plate 9.

Beef Cows and Calves on an Oat Crop in the Bongeen Area.

This crop is being used as a supplement to pasture.

weight at 12 months of age. Many dairy cows culled for some defect which renders them unsuitable for dairying can be profitably utilised for this purpose. Where a crop is available it is more profitable to place this type of cow on the crop than to slaughter her when only of tinner quality. In many cases both the cow and calf can be turned off fat when the calf is 9-12 months old. This system of fattening might give a greater return in beef per acre than any other method used in Queensland.

COST OF PRODUCING CROPS FOR GRAZING.

The cost of producing a crop for grazing will vary considerably from district to district and according to the crop and methods and machinery used by the farmer.

The cost per acre of producing a winter fodder crop for the central Darling Downs has been calculated (1952) to be about £5 or £6. Costs for summer crops would possibly be lower than this figure. These costs are given as a guide to those in other districts who may contemplate a crop-grazing programme.

RETURNS FROM CROP-FATTENED STEERS.

Steers of two to three years of age placed on crop in forward condition require, on the average, 100 days' grazing before they are ready for market. The weight gain during this period is in the vicinity of 1½-2 lb. per day, or a total of 150-200 lb. liveweight gain.

Assuming a 1,000 lb. liveweight steer on a crop showed a daily liveweight gain of 2 lb. for 100 days, the liveweight at slaughter would be 1,200 lb. At this weight, the steer would dress out at approximately 60%, thus yielding 720 lb. dressed weight. If slaughtered at 1,000 lb., it would probably have dressed out at 57%, yielding 570 lb. dressed weight. The end effect of the increase of 200 lb. in liveweight is therefore to increase the dressed weight by 150 lb. An estimated gain of 150 lb. of beef, saleable at 120s. per 100 lb., would return approximately £9 at a stocking rate of one beast per acre.

When stores are purchased at the same rate per 100 lb. as fats, the margin of profit is controlled by the amount of beef added, but fluctuations of values can either narrow or widen this margin.

Over and above this return there is frequently a further period of 50-60 days' grazing of poorer-quality crop which can be used to freshen a second lot of steers destined for early summer fattening on pasture after spring storms, or for other types of cattle. It is difficult to place a value on this period of grazing, as it will depend on the season and the type of cattle available for grazing, but it would be conservative to estimate the total return from a winter cereal crop at £11 per acre in terms of beef. This leaves a profit of approximately £5 15s. per acre over and above the cost of production of the crop.

These figures can, of course, only be taken as a general guide to possible returns. They take no account of the store and fat prices of cattle. As pointed out previously, provided the crop fattener has grass



Plate 10.
Two-Year-Old Crop-Fattened Steers Make Ideal Beef.

on which to hold stores, purchase can be made at times when prices are favourable. If the purchase must be made only when the crop is ready to graze, then considerable competition for stores is likely to be experienced and price per 100 lb. will be relatively high. Under the present system of marketing, crop-fattened cattle do not always command the premium for quality which they should, but because they can be placed on the market at the end of the season they do, in fact, usually meet a rather favourable market and may command a few shillings per 100 lb. more than pasture-fattened cattle on the same market.

GUIDE TO FEED REQUIREMENTS.

An attempt is made in this section to set out the approximate food consumption of beef cattle for maintenance and specified weight gains. The data given should be used as a guide only, as owing to the limited number of analyses and feeding trials carried out, variations may occur.

For convenience in estimating food requirements, Kellner's Starch Equivalent Tables are used. Here all food values are related to starch—that is, the starch content of the foods. If it takes 100 lb. of Sudan grass to produce as much liveweight gain as 12 lb. of starch, then Sudan grass is given a starch equivalent value of 12. Similarly, if it takes 100 lb. of a cereal crop to produce as much liveweight gain as 14 lb. of starch, then the cereal crop is given a starch equivalent of 14, and so with all other fodders.

Tables 1 and 2 show the English rationing standards for beef cattle and the food values of some roughages commonly used in Queensland. It is proposed, using these tables, to indicate how fodder crops may be fed to meet the food requirements of two types of steers.

TABLE 1.

English Rationing Standards for Beef Cattle.

(1) *Appetite and Maintenance Requirements at Different Liveweights :*

Liveweight of Animal.	Appetite (Dry Matter per Day).	Maintenance Requirements.	
		Starch Equivalent (S.E.) or Food Units per Day.	Digestible Protein per Day.
Lb.	Lb.	Lb.	Lb.
500	14·0	3·6	0·36
600	16·0	4·1	0·41
700	17·5	4·6	0·46
800	19·0	5·1	0·51
900	20·5	5·5	0·55
1,000	22·0	6·0	0·60
1,100	23·0	6·5	0·65
1,200	24·5	6·9	0·69
1,300	26·0	7·3	0·73
1,400	27·0	7·7	0·77
1,500	28·5	8·1	0·81
1,600	30·0	8·5	0·85

(2) *Food Requirements in Excess of Maintenance per Lb. of Liveweight Increase :*

Age and Condition of Animal.	Starch Equivalent.	Digestible Protein.
	Lb.	Lb.
Under 2 years—		
Stores	2·0	..
Fresh condition	2·25	0·15
Over 2 years—		
Stores	2·5	0·15
Fresh condition	2·75	0·15
Half-fat	3·0	0·10
Fat	4·0	0·05

TABLE 2.

Fodder Values of Commonly Used Roughages.

—	Dry Matter.	Starch Equivalent or Food Units per 100 Lb.	Digestible Protein per 100 Lb.
	%	Lb.	Lb.
Lucerne	20	12	3·0
Cereal Crops	15	14	1·5
Sudan Grass	20	12	1·5
Millet	20	14	1·3
Sweet Sorghum ..	20	12	1·0

1. Feeding Stores under 2 Years and Weighing about 700 lb.

From Table 1 it is seen that the requirements of a 700 lb. animal are 4.6 lb. starch equivalent (S.E.) for maintenance and 2.0 lb. S.E. for

production of 1 lb. liveweight increase—a total of 6.6 lb. S.E. The amounts of various fodders necessary to meet these requirements are as follows:—

Green lucerne—Table 2 shows that 100 lb. green lucerne contains 12 lb. S.E. Therefore, 55 lb. of green lucerne (yielding 6.6 lb. S.E.) is necessary to maintain an animal and to produce 1 lb. liveweight increase per day.

Cereal crops—Table 2 shows the starch equivalent of cereal crops to be 14. Therefore, 47 lb. of cereal crops are required to yield the 6.6 lb. S.E. necessary for maintenance and 1 lb. liveweight gain.

Sudan grass—As the starch equivalent of Sudan grass is 12, a daily ration of 55 lb. will yield the starch equivalent required for a 1 lb. liveweight increase.

Millet—The starch equivalent of millet is 14, so as with the cereal crops, 47 lb. are necessary for maintenance and 1 lb. liveweight gain.

Sweet sorghum—This feed is similar to green lucerne in starch equivalent value; consequently 55 lb. are necessary for maintenance and 1 lb. liveweight gain.



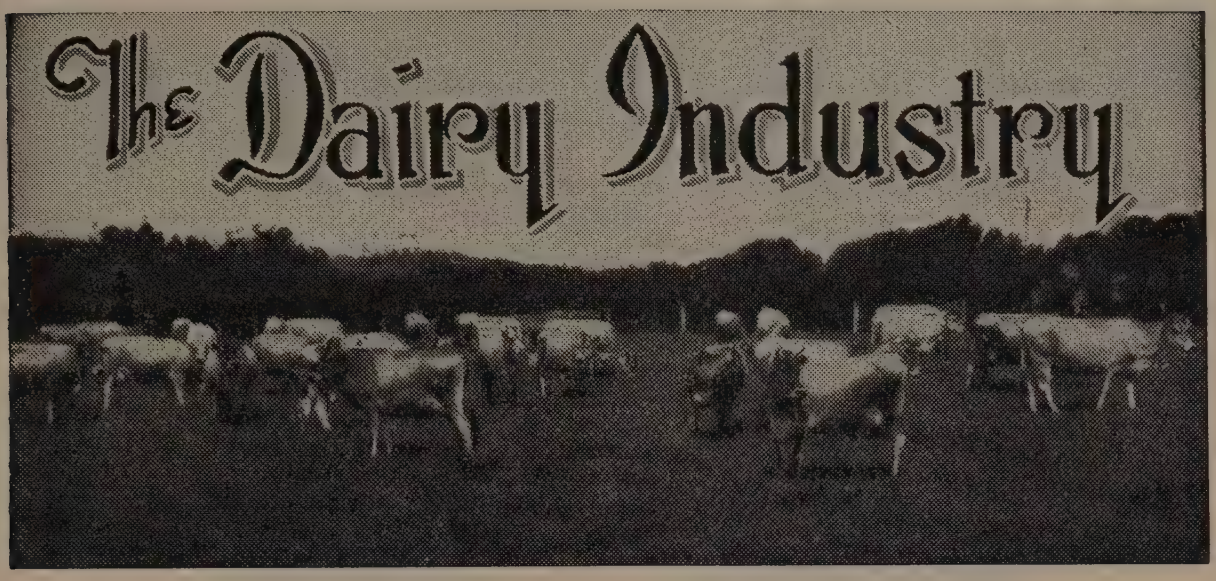
Plate 11.

These Young Bulls are Getting a Good Start in Life on an Oat Crop.

2. Feeding Stores over 2 Years and Weighing about 900 lb.

The requirements of a 900 lb. animal, as shown in Table 1, are 5.5 lb. S.E. for maintenance and 2.5 lb. S.E. for the production of 1 lb. liveweight gain, a total of 8·0 lb. S.E. This amount is supplied by the following weights of various feeds:—

	Per Day.
Green lucerne (S.E. value 12)	67 lb.
Cereal crops (S.E. value 14)	57 lb.
Sudan grass (S.E. value 12)	67 lb.
Millet (S.E. value 14)	57 lb.
Sweet sorghum (S.E. value 12)	67 lb.



Dairy Shed Practices and Dairy Processing in North Queensland.

D. S. ROBERTSON, Senior Adviser in Dairying.

THE dairying industry in North Queensland is conducted principally on the Atherton Tableland, with smaller settlements of dairy-farmers in the East Palmerston, Julatten and Daintree districts. There are also isolated dairy farms scattered along the coastal sugar lands from Tully north to Cairns, but these are of minor importance when compared with the aggregation of farms in the other areas.

The map in Plate 1 gives a general picture of the dairying districts in the North. Factories are located at the following centres:—

Malanda.—The Atherton Tableland Co-operative Butter Association, which has the largest factory in the North, handles milk and manufactures butter. It has almost 500 suppliers of milk and cream, of whom about one-third supply milk and the others cream.

Millaa Millaa.—The Millaa Millaa Central Tableland Butter Association, which manufactures butter, has about 150 suppliers.

Ravenshoe.—The Evelyn Tableland Dairymen's Co-operative Butter Association, which manufactures butter, draws cream from about 70 farms.

Innisfail.—The Millaa Millaa Central Tableland Co-operative Butter Association operates a branch factory which pasteurises milk for Innisfail and nearby towns. The milk is obtained from East Palmerston and farms at Millaa Millaa.

Townsville.—The Atherton Tableland Co-operative Butter Association has a milk depot from which milk is distributed to the city of Townsville and as far west at Mt. Isa. Ice cream is also manufactured. All milk is forwarded from the head factory at Malanda.

Cairns.—The Polar Star Ice Cream Company manufactures ice cream at its factory and also pasteurises milk for the city of Cairns. About 40 producers supply milk to the factory. Some half of the



Plate 1.

Sketch Map Embracing the Main Northern Dairying Districts.

requirements are received from these direct suppliers and the remainder is received by road milk tanker from the Malanda factory. The Albion Ice Works acts as distributing agent for the supply of warm milk to Cairns. This milk is drawn from the Atherton Tableland.

Daintree.—The Daintree Co-operative Butter Association manufactures butter for the local trade. It has only 15 suppliers.

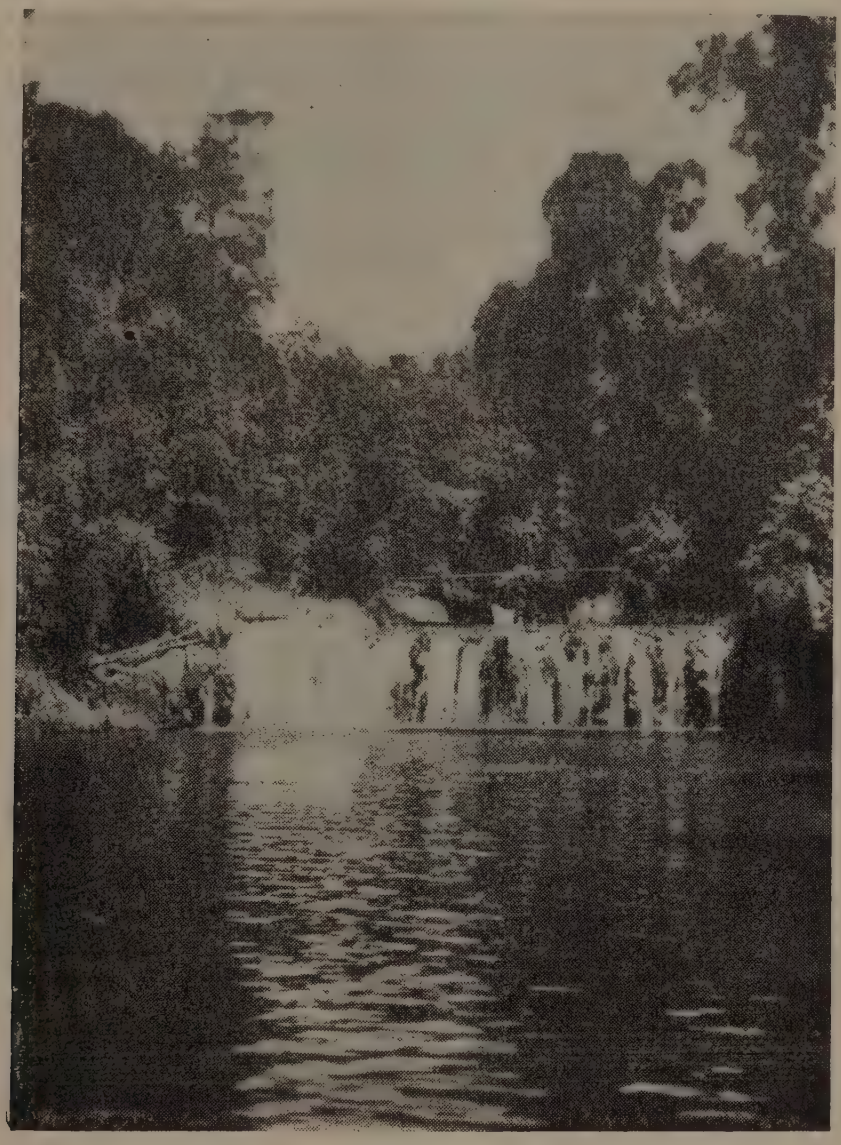


Plate 2.
Malanda Falls, on the Johnstone River.

GENERAL LAYOUT OF DAIRY BUILDINGS.

As the northern districts are in a monsoonal rain area, the layout of dairy buildings differs somewhat from those adopted in the drier districts of the State. In order to combat the heavy rain, a large yard is generally concreted and roofed, and this is used as a drying yard for the cows coming from the pastures to the bails for milking. In addition, the cows are provided with a race in front of the bails so that they may be directed from the building along a set route. This race is concreted and that portion in front of the bail doors is walled and roofed so that rain does not enter through the bail door when it is opened. The large holding yard which forms part of the shed may make the interior of the building gloomy in wet weather, so home electric lighting plants are often installed in the sheds to compensate for the

absence of sunlight. Farmers are adopting the system of concrete races and paths in the vicinity of the shed, as used in the southern States, to minimise the mud problem.

Practically every shed on the Tableland is supplied with an abundance of water, which is used for hosing out the bails and also in tubular water coolers for milk-cooling. Steam sterilizers or set-in coppers provide the hot water for cleaning utensils.

Nearly every shed is fitted with a milking machine, the three-unit plant being most used. Electricity has been laid onto some farms. This power comes from the Barron Falls Hydro-electric Supply Station at Kuranda, and where it is avai'able, all machinery, including water pumps, is powered by electricity. On those farms where milk is separated, skim-milk pumps are usually fitted at the dairy shed to pump the skim-milk direct to the piggery.

DAIRY SHED METHODS.

Many of the producers supply milk for the liquid milk market. They are very conscious of the necessity for strict cleanliness and correct milking methods if the milk is to be of the desired standard, and consequently the following methods are commonly followed:—

(1) Washing the cow's udder with a cold chlorine rinse and then drying.

(2) Stimulating milk let-down by washing the udder just before the cow is milked.

(3) Using the strip cup and discarding the first few squirts of fore-milk.

(4) Machine-stripping of cows.

(5) Dipping the teat-cups in a chlorine solution between cows to aid in preventing the spread of mastitis from cow to cow.



Plate 3.

A Well Kept Atherton Tableland Dairy Farm.

Although the above routine may appear complex and time-consuming to those who have never adopted it, farmers in the North who practice it speak highly of the results. Over the past three years an intensive drive with gratifying results has been made by local officers of the Division of Dairying to promote the use of these proven methods.

Milk delivered to the factory is water-cooled on the farm, as there is usually a plentiful supply of running water on every farm. This cooling retards bacterial growth in the milk. All milk is, of course, strained through cotton-wool filter pads on the farm before despatch to the factory. Cream is often stored in water-cooling troughs on the farm while awaiting delivery, and in some cases these troughs have continuously running water. Some farmers are erecting charcoal coolers for holding cream on the farm, while tower coolers for cooling milk are growing in popularity. Dairy refrigerators have been installed on some farms, but owing to the abundance of water and the cool nights, the demand for these on the Atherton Tableland is not so great as in the hotter parts of the State.



Plate 4.
Stud Jersey Cows on the Atherton Tableland.

TRANSPORT.

The transport of dairy produce from the farm to the factory can be difficult in a high-rainfall area, but the difficulties may be almost insuperable if the roads are poorly surfaced. Fortunately, transport of milk and cream on the Tableland presents no insurmountable difficulties, as nearly all farms are on all-weather roads. Even minor side-roads are gravelled so that they will stand up to the heavy rain. The nature of the roads enables regular deliveries of milk and cream to be made in all seasons. Factories arrange a roster system of deliveries, and trucks arrive at the factory according to a time-table which ensures that factory treatment is not delayed. Milk is collected every day, and the milk deliveries are timed to reach the factories as early as possible. Cream is collected three days a week only. Most carriers use two trucks on the run; this enables one truck to be used to pick up milk as early as possible and the second to go out later for the cream.

LABORATORY CONTROL.

The Malanda factory has equipped a laboratory where control is exercised over the raw and treated produce. This laboratory is under the guidance of officers of the Division of Dairying, and farmers' samples of milk are examined as well as the milk and cream at the factory. Assistance is also given to suppliers of other factories by examining and reporting on samples sent in by them. The laboratory has proved of value in controlling the quality of dairy produce and the efficiency of processing.



Plate 5.

Members of a Tableland School Calf Club Parade Their Charges.

MARKETS.

The main markets for milk produced in North Queensland are to be found on the coast. By mutual agreement, areas for the supply of pasteurised milk are as follows:—

(1) The Polar Star Ice Cream Company, of Cairns, supplies Cairns and the immediate neighbourhood.

(2) The Millaa Millaa Central Tableland Co-operative Dairy Association branch milk factory at Innisfail supplies milk to the area extending along the coast from Gordonvale to Ingham.

(3) The Atherton Tableland Butter Association branch milk factory at Townsville distributes milk as far west as Mt. Isa.

The Malanda factory distributes milk in Atherton and Mareeba.

The butter factories on the Tableland market the butter produced through the North Queensland Co-operative Marketing Federation. This body is responsible for the storage and distribution of the butter, and all factories market under the trade mark "Sunbeam." The refrigerated space necessary for storing the butter is supplied by the Malanda factory, where large rooms are available to the Federation. The local trade takes the bulk of the butter produced in the North, but in the flush season, generally from January to May, some butter is packed for export. This

is railed from the Malanda cold stores to Cairns, where it is loaded direct onto overseas ships. Commonwealth officers grade the butter before consignment at Malanda. Butter is also packed for transport to centres in the Gulf and to towns in the far west. This is transported by rail. The factory at Daintree does not market through the Federation but supplies direct to the town of Mossman, any surplus being sold in Cairns.

ADVISORY SERVICES.

The North is well served in respect of official farm advisory services. The Department of Agriculture and Stock also operates a Regional Experiment Station at Kairi, on the Tableland, which incorporates an experimental dairy in which modern dairying methods are demonstrated. Under the Commonwealth Dairy Industry Efficiency Scheme, demonstration farms are being conducted by the owners under the guidance of Departmental officers in respect of various demonstration projects.

Junior Farmer Clubs, which are strong on the Tableland, are the means of imparting to the young farmer the latest information pertaining to the industry in which he is engaged. Members of these clubs are granted regular trips to southern districts for the purpose of comparing methods.

School Project Clubs are a valuable medium of imparting information on dairying to the school child and fostering in him an interest in his future work.

FACTORY TREATMENT.

The North Queensland factories are well equipped with efficient machinery for the handling and treatment of dairy produce. This is reflected in the excellent results obtained in factory surveys of milk quality, and also in the standard of bacteriological and chemical results



Plate 6.

The Millaa Millaa Central Tableland Butter Association's Milk Factory at Innisfail.

in the Queensland Butter Improvement Service. Automatic butter-cutting, packing and patting machinery is a feature of the larger factories, while bottling and can-washing machines are used.

The Atherton Tableland Co-operative Butter Association, Malanda, handles about 1,000,000 gallons of milk yearly for the market milk trade. The output of butter for the past three years was—

	Lb.
1951–52	1,815,604
1950–51	2,389,032
1949–50	2,328,094

The Millaa Millaa Central Tableland Co-op. Dairy Association pasteurises about 250,000 gallons of milk yearly at its Innisfail factory and its production of butter at its Millaa Millaa factory in recent years was—

	Lb.
1951–52	902,220
1950–51	915,510
1949–50	901,220

The production of butter at the Evelyn Tableland Co-operative Dairy Association factory at Ravenshoe and the Daintree Co-operative Dairy Association factory at Daintree was—

	1951–52. Lb.	1950–51. Lb.	1949–50. Lb.
Ravenshoe ..	419,601	538,194	497,438
Daintree ..	80,548	81,689	83,602

FUTURE POSSIBLE DEVELOPMENTS IN THE INDUSTRY.

The greatest scope for future development lies in the maximum use of milk and its products. The present market for milk grew up out of the needs arising from the wartime concentration of troops on the Tableland. This market was extended to the civilian population, and has not nearly reached its maximum. However, for economic handling, the trend in the future may be in the direction of milk products, such as cheese and dried milk. Large numbers of Europeans live on the Coastal Plain and in the area adjacent to Mareeba and Dimbulah, and it is there that a market exists for various types of cheese. At present, all cheese consumed in the North is made in southern Queensland, and the new market, adjacent to the dairying areas of the North, will no doubt eventually be supplied from this area. Such new markets will provide a welcome stimulus to the industry, and will assist in the better farming of what now may be classed as marginal lands. It is an accepted economic fact that healthy markets stimulate and encourage better farming methods and better utilization of the land.

Therefore, any expansion of the industry in this part of the State may well lie in the direction of cheese and milk products.

Dairy Farm Competition, 1951-52.

R. A. PAUL, Director of Field Services, Division of Dairying.

AS a result of experience gained in the previous two Dairy Farm Competitions, a number of alterations were made in the conditions and conduct of the competition under review.

Firstly, the periods of judging were reversed, so that the first judging was carried out between September 1 and November 30, 1951, and the second judging between February 1 and April 30, 1952. The reason for the change was to allow of a quick follow-up with the holding of field days, which was not practicable under the previous system, as results could not be finalised before the onset of the wet months. Secondly, the number of zones was decreased from 16 in previous competitions to 11. Lastly, a division was made into six main sections, in each of which first and second prizes were awarded in addition to first, second and third prizes in the "Whole Farm" competition.

The alterations made had the desired effect of widening farmer interest, and a total of 194 entries was received, compared with 104 in the previous competition. Unfortunately, severe drought conditions prevailed throughout the State during almost the complete period of the competition; 20 farmers withdrew between the closing date of entries and the first judging, and a further 21 before the second judging, leaving a total of 153 farmers competing.

Due to the large number of entries received in Zone 9 it was decided to divide it and include a further zone, shown as Zone 9A. The six main sections on which the farms were judged are shown below; these were further divided into 49 sub-sections for the assistance of officers carrying out the judging.

Section.	Points.
A. Efficiency of Land Usage	1,000
B. Farm Buildings	460
C. Dairy Buildings	380
D. Herd Management	950
E. Farm Economy	600
F. Animal Feeding	610
Total	4,000

Prizes awarded in each zone were:—"Whole Farm" Competition: First, £50 and Trophy; Second, £30 and Pennant; Third, £20 and Certificate. Sectional Prizes: First, £15 and Pennant; Second, £5 and Certificate.

The competition was financed from the Commonwealth Dairy Industry Efficiency Grant and conducted and judged by officers of the Divisions of Animal Industry and Dairying.

Prize-winners in the 1951 Competition were handicapped 80 points for first, 40 for second and 20 for third in the "whole farm" competition. No handicaps applied in the sections.

LIST OF PRIZE-WINNERS.

"WHOLE FARM" COMPETITION.

Zone.	Entrant.	Handicap.	Net Points.
1	1. S. A. Cramb, Upper Caboolture	..	2,518
	2. W. Hamilton, Armstrong Creek, *via* Dayboro'	..	2,484
	3. T. J. Bennetts, Moggill	..	2,474
2	1. R. J. Barton, Veresdale	..	2,903
	2. H. L. Stark, Kalbar	80	2,824
	3. P. N. and S. P. Rackley, Harrisville	..	2,807
3	1. V. E. Millewski, Minden	..	3,053
	2. A. J. Egan, Toogoolawah	20	2,820
	3. J. P. Schlecht, Lark Hill	40	2,658
4	1. N. R. Potter, Wellcamp	..	2,765
	2. A. E. Pechey, Pechey	40	2,693
	3. C. H. B. Huey, Sabine	40	2,518
5	1. I. B. Skerman, Kaimkillenbun	80	2,724
	2. J. A. Smith, Chinchilla	..	2,603
	3. A. T. Curd, Jandowae	..	2,501
6	1. P. Kerlin, Killarney	..	3,039
	2. R. J. Browne, Yangan	80	2,865
	3. M. C. Lester, Glengallan	..	2,834
7	1. A. W. Webster, Maleny	..	3,005
	2. J. J. Ahern, Conondale	..	2,923
	3. W. Allen and Sons, Chatsworth	20	2,862
8	1. W. and E. Adlem, Kingaroy	..	2,726
	2. F. H. Sippel, Redgate	40	2,576
	3. T. J. Champney, Crawford	80	2,546
9	1. J. C. C. McCall, Tiaro	..	2,609
	2. Carswell and Co., Gootchie	..	2,496
	3. W. Pitt, Childers	..	2,381
9A	1. W. H. Doss, Degilbo	..	2,801
	2. R. R. Radel, Coalstoun Lakes	..	2,719
	3. P. E. Paulsen, Mundubbera	..	2,609
10	1. G. E. Muller, Mackay	80	2,794
	2. H. J. Kraatz and Son, Etna Creek	..	2,633
	3. F. J. Bowman, Littlemore	..	2,571
11	1. R. S. Griffiths, Moregatta	80	2,848
	2. H. Sigley, Jaggan	40	2,708
	3. D. N. Beattie, Chilverton	..	2,586

SECTIONAL DETAILS.

Table 1 has been compiled to give an overall picture of the average efficiency of the competitors in each section of the competition. The average score of all the competitors in any zone is given, together with that of the competitor gaining the highest score in that section. A study of the table shows very clearly that many of the farmers are highly efficient in particular sections, but it also indicates that the majority of the entrants have ample scope to improve before they can hope to compete with the more efficient, as represented by the highest score.

TABLE 1.

Highest Percentage Score in each Section and the Average Percentage Score of all Competitors.

Zone.	——	Sec. A.	Sec. B.	Sec. C.	Sec. D.	Sec. E.	Sec. F.
1	Highest Score ..	77·0	82·7	91·3	68·8	60·8	48·9
	Average Score ..	69·4	72·6	83·5	52·1	34·1	41·8
2	Highest Score ..	80·5	90·4	97·5	66·9	69·0	80·4
	Average Score ..	75·1	83·5	88·9	61·6	40·0	74·6
3	Highest Score ..	88·5	92·7	87·9	69·9	58·5	83·1
	Average Score ..	68·9	78·6	82·6	53·3	28·8	65·5
4	Highest Score ..	75·5	82·5	79·2	75·1	51·0	77·0
	Average Score ..	47·9	70·4	73·5	62·2	35·4	61·5
5	Highest Score ..	60·5	90·4	90·5	71·3	54·6	79·7
	Average Score ..	51·7	82·9	86·5	65·2	40·1	69·5
6	Highest Score ..	83·8	90·0	96·1	84·7	57·8	84·5
	Average Score ..	63·6	72·8	85·5	68·8	37·8	69·8
7	Highest Score ..	61·5	92·4	98·4	77·2	95·8	83·8
	Average Score ..	43·1	75·9	81·7	59·7	57·1	72·5
8	Highest Score ..	78·3	84·0	86·3	70·0	58·8	75·6
	Average Score ..	59·6	69·1	70·8	52·0	29·5	55·6
9	Highest Score ..	78·0	86·0	92·9	68·3	62·7	70·2
	Average Score ..	57·4	75·3	78·0	47·0	20·6	57·0
9A	Highest Score ..	82·5	84·8	80·3	70·0	43·3	64·8
	Average Score ..	66·3	62·7	64·4	45·6	20·1	52·0
10	Highest Score ..	83·7	92·3	92·1	70·8	40·0	75·7
	Average Score ..	69·8	82·5	84·5	56·5	23·8	61·6
11	Highest Score ..	71·5	85·4	88·0	72·7	73·5	80·8
	Average Score ..	63·8	68·1	82·2	60·5	49·9	68·6
All Zones	Average Score ..	61·5	74·0	78·7	54·9	33·1	61·7

Section A. Efficiency of Land Usage.

This section includes the provision of pastures and crops; conservation and storage of hay, silage and grains; and the maintenance and conservation of soil fertility. The average score for all competitors was 61.5% of the maximum points for the section. A number of competitors scored very well in this section, notably V. E. Millewski (Minden), who was the winner of the section in Zone 3. Mr. Millewski's farm consists of 100 acres of what was originally brigalow scrub land, with 46 acres under cultivation. The crops grown include oats, wheat, mangolds, white panicum, sorghum, maize, Poona pea, and lucerne. Soil fertility is maintained by the use of animal manure, whilst rotational grazing is carried out with the aid of two electric fences. A spray irrigation plant is available when required. A good hayshed is provided and ample lucerne and cereal hay is conserved for the stock. Further reserves are provided in the form of grain in a vermin-proof shed and tank.

Mr. P. Kerlin (Killarney), who won this section in Zone 6, also scored heavily. Improved pastures of Rhodes grass and kikuyu have been laid down, whilst cultivations include Japanese millet, oats and canary grass, with wheat and barley for grain. An underground concrete silo is on the property, whilst a hayshed contains lucerne hay, and grain is stored in a vermin-proof shed. Lime is used on the pasture land, and slight erosion troubles are being countered by the establishment of grassed waterways, ploughing-in of leguminous crops and stubble mulching.

The judges' remarks in general indicate that further attention is required in relation to fodder conservation particularly and also to soil conservation and maintenance of fertility.



Plate 1.

Cultivation Paddocks on the Property of Mr. W. Hamilton, Dayboro.
This farm won Section A (efficiency of farm usage) in Zone 1.

Section B. Farm Buildings.

This section includes farm layout, farm buildings and farm machinery. The average points scored in the section were 74.0% of the maximum, indicating a satisfactory standard of efficiency in relation to the provision and care of buildings and machinery, but further attention could be paid to subdivision and provision of adequate watering points.

Section C. Dairy Buildings.

This section includes dairy buildings, layout, equipment and milking methods. Here again, with an average points score of 78.7%, the standard is satisfactory. The judges' reports indicate that dairy buildings and equipment are in very good condition and well cared for, but that in some instances improved layout of the yards and buildings would result in a speeding up of milking operations.

Competitors who scored very creditably in this section are I. McDougall (Veresdale), winner in Zone 2, and W. Allen and Sons (Chatsworth), winners in Zone 7. These premises are described in some detail in the article on the Dairy Building and Equipment Competition published in the *Queensland Agricultural Journal* for December, 1951, and January, 1952.



Plate 2.

Well Subdivided Pasture and Cultivation Paddocks on the Property of Mr. G. A. Hinze, Oxenford.

Section D. Herd Management.

This section includes breeding and management of the herd sire, control of service, seasonal calving practices, herd records, disease control measures and average production per cow.

The average points score in this section was 54.9% of the maximum points, a situation that cannot be considered satisfactory. Too few farmers used bulls of known production backing, and the figures show that of the 254 bulls in use, although 216 (85%) were from purebred parents, 68 of these (31%) had no record of production backing in the near male or female line. It does appear that those farmers supplying the wholemilk market are more at fault in this regard, the majority being content to get the cows in calf and to buy in replacements rather than breed their own.. This is a short-sighted policy in relation to increased production from the farm, particularly in view of the fact that trials carried out by the Division of Animal Industry show that healthy, quick-growing calves can be raised very economically on as little as 25 gallons of wholemilk.

Adequate control of service does not appear to be exercised, as only 56% of the entrants made an attempt to calve the cows down in the optimum months. Statistics compiled from records obtained from the Grade Herd Improvement Scheme show that on a State basis an increase in production of 17% is to be expected by calving down in the months July to September compared with the other months of the year.

Some slight variations in these months apply to the various districts, but in general, calving from June to October will give an appreciable increase of approximately 15% over the other months of the year.

Due to drought conditions prevailing for almost the whole of the period February 1, 1951, to January 31, 1952, for which the production figures were taken, cow productions are considerably lower than in the previous competition. The average fell to 127 lb. commercial butter, compared with 173 lb. in the previous competition. Only one entrant exceeded 300 lb. commercial butter; 8 exceeded 250 lb. and 11 exceeded 200 lb.

Mr. A. M. Lee (Goomburra), the winner of the section in Zone 6, had an average production of 331 lb. commercial butter from 18 cows. Mr. Lee's herd is composed mainly of Jersey grade cows, with only a few registered. The sire in use has very good production backing and is strictly controlled. All cattle are branded and a dry period of eight weeks aimed at, whilst cows close to calving are "steamed up" on good cultivation feed prior to freshening.

Section E. Farm Economy.

This section includes production of commercial butter per acre, labour cost per pound of commercial butter, and method of farm bookkeeping.

The average points score was 33.1% of the maximum points. This is not a satisfactory position, although the low average has been affected very considerably by the severe drought, which while lowering production per acre raised the labour cost and so in both instances decreased the points scored.



Plate 3.

A Convenient Type of Fixed Calf-Feeding Bails on the Property of Messrs. W. J. and A. L. Semgreen, Coolabunia West.

The average production per acre for all competitors was 15 lb. commercial butter, compared with 23 lb. in the previous competition. Eleven entrants had a production over 50 lb., 3 over 75 lb. and 1 over 100 lb. The Estate A. A. Alcorn (Maleny), winner of the section in Zone 7, had a production of 134 lb. per acre, whilst A. W. Webster (Maleny), winner of the second prize in the section in the same zone, had a production of 99 lb. per acre, and P. Ruddle, also of Maleny, a production of 92 lb. per acre. These results have been achieved by sound management practices, including renovation and fertilizing of pastures, subdivision and use of electric fences, provision of shade, shelter and a plentiful water supply, and extensive use of animal manure.

Section F. Animal Feeding.

This section includes management of young stock, pig-raising, and condition of stock generally. The average points score in the section was 58.8% of the maximum points.

In Zone 1 none of the competitors kept pigs and this is reflected in the low scores shown in Table 1 for this zone.

Better facilities are required for the raising of young stock in that more and better paddocks are required to raise healthier calves and heifers as herd replacements.

TABLE 2.

Farm Economy Details—Average and Highest Figures.

Zone.	——	Acres.	Cows.	Acres per Cow.	Production. (Lb. Commercial Butter).	
					Per Acre.	Per Cow.
1	Average	288	55	5·2	26	139
	S. A. Cramb ..	114	29	3·9	46 (56)	182
2	Average	340	51	6·6	29	189
	N. J. Barton ..	200	65	3·1	64	197 (287)
3	Average	324	57	5·4	20	112
	V. E. Millewski ..	100	30	3·3	65	215
4	Average	343	38	9·0	23	208
	N. R. Potter ..	300	37	8·1	36 (37)	294
5	Average	835	68	12·2	13	161
	I. B. Skerman ..	776	60	12·9	17 (21)	221 (227)
6	Average	194	28	7·0	30	207
	P. Kerlin	150	27	5·5	49 (60)	271 (331)
7	Average	251	67	4·0	42	156
	A. W. Webster ..	148	72	2·0	99 (134)	204 (236)
8	Average	385	52	7·4	17	126
	W. Adlem ..	310	48	6·4	46	295
9	Average	1,167	57	20·2	4	82
	J. C. C. McCall ..	59	22	2·7	41 (88)	111 (155)
9A	Average	706	70	10·0	8	84
	W. H. Doss ..	500	54	9·2	16 (21)	144 (163)
10	Average	497	57	8·6	11	94
	G. E. Muller ..	120	34	3·5	40	142 (177)
11	Average	269	59	4·5	39	179
	R. S. Griffiths ..	210	56	3·7	70	261
Average all Zones ..		481	57	8·4	15	127

In general, satisfactory pig accommodation is provided and breeding stock are of good quality, but judging from the number of pigs sold from the farms, and the number of calves raised, better utilisation could be made of the available skim-milk to raise more pigs, more calves or both. Skim-milk is a very valuable foodstuff high in protein, and full use should be made of it in animal feeding as a supplement to other feeds rather than as the main food, as is too often the case.

Table 2 has been compiled to show in each zone the average number of acres used for dairying, the average number of cows, and the average production per acre and per cow compared with the figures of the winner of the first prize in the "whole farm" competition. The figures in brackets are the highest obtained in the zone. The number of cows has been obtained by adding the cows milking and dry each month and dividing by 12.

The table shows that there are very significant differences in average carrying capacity and production between zones, as can be seen by comparing Zones 7 and 9.

GENERAL.

It is very pleasing to be able to report the increased interest shown in the competition and to learn that such competitions are playing their part in increasing efficiency in dairy-farm management. As a direct result of the competitions and the Field Days held in conjunction with them, officers of the Department have been approached by farmers for advice regarding pasture establishment and management, selection of suitable sires, varieties of winter and summer crops, cooling facilities for dairy produce, layout of buildings, yards, etc., and many other aspects of management.

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Pure-Bred Dairy Cattle Production Recording—Details for 1951-52.

S. E. PEGG, Chief Adviser, Herd Recording Section.

RECORDS OF COWS COMPLETING LACTATION RECORDS DURING THE YEAR ENDED 30TH JUNE, 1952.

EXPLANATION OF TABLE.

Owners are listed alphabetically within each breed and cows grouped according to name of sire.
Cows milked three times a day during some period of their lactations are indicated by an asterisk (*).
In brackets after the owner's name are shown the breed and the number of cows whose production records are given.
The butterfat production required for entry to the Advanced Register varies according to the age, and is as follows :—

Junior 2-year-old (under 2½ years at calving)	230 lb. butterfat
Senior 2-year-old (between 2½ and 3 years at calving)	250 lb. butterfat
Junior 3-year-old (between 3 and 3½ years at calving)	270 lb. butterfat
Senior 3-year-old (between 3½ and 4 years at calving)	290 lb. butterfat
Junior 4-year-old (between 4 and 4½ years at calving)	310 lb. butterfat
Senior 4-year-old (between 4½ and 5 years at calving)	330 lb. butterfat
Mature (5 years and over at calving)	350 lb. butterfat

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butterfat.
				Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN.						
BRADFORD, A., Yangan, *via* Warwick (A.I.S., 3).						
Kanangra Sadie	Ashstead Royal Major	M	210	5,409	3·9	212
Kanangra Duchess	Bileena Venture	J.4	240	3,987	4·2	166
Kanangra Melba 2nd	Bileena Venture	S.4	273	6,313	4·3	273
CROOKEY, J., Allora (A.I.S., 5).						
Arolla Lucy 3rd	Arolla Jupiter	J.2	240	4,290	4·4	187
Arolla Ruth 5th	Bingleigh Vision's Sultan	J.2	273	6,035	4·0	243
Arolla Pet 3rd	Bingleigh Vision's Sultan	S.2	273	9,249	4·4	405
Arolla Beauty 16th	Bingleigh Premier	J.3	273	5,452	4·9	269
Arolla Pet 4th	Blacklands Limerick	J.3	273	6,823	4·1	279
DAVIS, W. D., Chinchilla (A.I.S., 18).						
Wamba Gem 4th	Bingleigh Rosette's Victory	J.2	180	3,150	4·0	126
Faversham Daisy 5th	Croydon Marchese	M	273	7,378	3·3	243
Wamba Thelma	Fairvale Noble	J.2	273	5,941	3·6	212
Wamba Dahlia 3rd	Fairvale Noble	J.2	273	5,882	3·6	209
Wamba Mafalda	Fairvale Noble	J.2	240	5,301	3·9	206
Wamba My Gift 3rd	Fairvale Noble	J.2	273	5,255	3·6	191
Wamba Grace 2nd	Fairvale Noble	J.2	273	5,167	3·5	181
Wamba Gem 3rd	Fairvale Noble	J.2	210	3,186	3·8	122
Wamba My Gift 2nd	Fairvale Noble	S.2	273	7,152	3·5	253
Wamba Pride 2nd	Fairvale Noble	S.2	240	5,163	3·7	191
Wamba Ruby	Fairvale Noble	S.2	273	4,727	3·9	186
Fairvale Doris 13th	Fairvale Reward	M	273	7,928	4·2	335
Blacklands Envy 58th	Parkview Arbitrator	J.2	240	4,500	3·4	154
Blacklands Foremost 7th	Parkview Arbitrator	J.2	150	2,700	3·5	95
Bunyaview Mafalda 8th	Trevor Hill Reflection	M	273	6,351	4·0	257
Bunyaview Rosette 6th	Valera Jean's Pride	J.2	273	7,509	3·7	280
Bunyaview Thelma 17th	Valera Jean's Pride	J.3	273	7,890	4·1	321
Bunyaview Mafalda 9th	Valera Jean's Pride	S.3	240	3,918	3·7	145
DAY, V. S., Veresdale, *via* Beaudesert (A.I.S., 5).						
Applegarth Miss Rosina	Applegarth Rosemount	M	273	7,063	3·7	284
Ellismore Rosina	Bingleigh Jean's Monarch	J.2	273	6,185	4·0	250
Bingleigh Rosette 5th	Bingleigh Jean's Sultan	M	273	8,029	4·6	371
Ellismore Fairy Queen 2nd	Cedar Valley Prospector	J.2	273	5,060	3·7	185
Millstream Beryl 16th	Sunnyview Bruce	M	273	9,970	3·6	354
ENGLISH, J. K., Malanda (A.I.S., 7).						
Eachamvale Rosie 26th	Blacklands Sperry	J.2	273	6,886	4·6	318
Eachamvale Dainty	Blacklands Sperry	S.3	273	6,905	4·0	277
Eachamvale Rosette	Blacklands Sperry	S.3	273	6,400	4·1	261
Eachamvale Rosy 25th	Cedargrove Commodore 2nd	M	273	8,924	4·1	365
Eachamvale Crimson	Eachamvale Standard	M	273	7,113	3·9	277
Eachamvale Lovely	Meadowvale He'll Do	M	240	6,396	4·3	274
Eachamvale Wattle	Meadowvale He'll Do	M	210	6,924	4·0	274

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
EVANS, E. G., Maleny (A.I.S., 5).						
Lauraven Mermaid	Arley Statesman 32nd	J.2	273	5,538	4·2	231
Lauraven Buttercup 3rd	Arley Statesman 32nd	J.2	273	5,273	4·4	231
Lauraven Dawn 2nd	Arley Statesman 32nd	J.2	273	6,251	3·5	217
Lauraven Dawn	Arley Statesman 32nd	S.2	273	6,544	3·5	231
Cedargrove Lily 9th	Rosenthal Scout	S.3	273	6,447	3·8	244
EVANS, J. F., Malanda (A.I.S., 6).						
Evansvale Champion	Evansvale Silvermine	J.2	150	5,061	4·0	204
Evansvale Velvet	Penrhos Bounty	J.3	180	4,914	4·8	235
Beechwood Mignonette 60th	Rosemount Cherry's Prince	M	273	7,634	4·3	329
Evansvale Bonny 6th	Sunnyview Principal	J.2	240	5,469	3·7	203
Evansvale Floss 6th	Sunnyview Spearvale	J.2	273	6,013	3·8	229
Evansvale Joan	Sunnyview Spearvale	J.3	273	6,301	4·7	296
EZZY, A. F., Mt. Emlyn, *via* Millmerran (A.I.S., 8).						
Jamberoo Winnie 2nd	Brooklyn Terrace Banker	M	240	6,123	4·0	247
Jamberoo Dignity 5th	Murray Bridge Florrie's Prince	M	273	9,956	4·1	407
Nullabowry Winnie 3rd	Jamberoo Banner	J.2	273	5,124	3·4	194
Nullabowry Dignity	Jamberoo Banner	S.2	273	7,268	3·5	287
Nullabowry Rose 3rd	Jamberoo Banner	J.3	273	7,185	4·3	306
Nullabowry Princess 4th	Jamberoo Banner	S.3	180	3,846	3·6	153
Nullabowry Rose 2nd	Jamberoo Banner	J.4	273	6,425	3·9	248
Nullabowry Winnie 2nd	Jamberoo Banner	M	273	6,403	4·0	254
FAIRYMEAD SUGAR CO. LTD., Bundaberg (A.I.S., 4).						
Alfa Vale Betsy 2nd	Alfa Vale Paisley	M	273	7,490	3·9	291
Tantitha Star	Beauna Vista Blamey 2nd	M	273	5,545	3·7	204
Tantitha Clover	Greyleigh Fortune	J.2	273	7,182	3·1	226
Tantitha Princess 2nd	Sunny View Sun Valley	S.2	273	7,025	3·0	212
FLESSER, W., Boyland, *via* Beaudesert (A.I.S., 6).						
Roshill Queenie 21st	Dnalwon King Lear	J.2	273	5,270	3·6	188
Roshill Calm 18th	Dnalwon King Lear	J.2	180	3,588	3·2	116
Roshill Melba 6th	Dnalwon King Lear	J.3	273	5,270	3·6	188
Roshill Almond 14th	Dnalwon King Lear	J.3	273	5,588	3·3	185
Roshill Redberry 16th	Dnalwon Felix	J.2	273	6,415	3·8	246
Roshill Felix Queenie	Dnalwon Felix	S.2	273	6,173	3·6	223
FOGG, J. H., Toogoolawah (A.I.S., 16).						
Aynesley Florrie 7th	Aynesley Ethel's Victory	S.2	90	1,058	3·7	39
Ventnor Jewel 2nd	Berry Carson	S.2	180	3,867	3·6	139
Ventnor Heather 3rd	Berry Carson	S.2	240	3,294	4·1	136
Ventnor Mab 41st	Berry Carson	J.3	273	6,581	4·2	276
Ventnor Marie 28th	Berry Carson	J.3	273	6,595	3·9	260
Ventnor Cherry	Berry Carson	S.3	273	4,130	3·6	150
Ventnor Shamrock 4th	Berry Carson	M	273	5,188	4·0	207
Aynesley Jane 16th	Haroldae Dandy	S.3	90	1,377	4·2	58
Morden Dahlia 8th	Fairvale Red Prince	S.2	273	4,442	3·8	168
Cedar Valley Rosette	Kyabram Masterpiece	J.4	273	9,145	3·9	357
Cedar Valley Rosette	Kyabram Masterpiece	J.4	305	9,695	3·9	376
Cedar Valley Rosette	Kyabram Masterpiece	J.4	330	10,221	3·9	396
Aelkcor Rosette	Ventnor Carson 11th	S.2	150	2,601	4·0	105
Aelkcor Helen	Ventnor Eros 3rd	J.2	273	5,710	3·9	226
Ventnor Eros's Judy	Ventnor Eros 3rd	S.2	273	4,439	4·1	181
Fernbank Ventnor's Licorice	Ventnor Romeo 4th	S.2	273	5,833	3·9	230
Aelckor Licorice	Ventnor Romeo 4th	S.2	273	4,577	3·5	158
Wilga Plains Ruby 18th	Wilga Plains Guardsman	S.4	273	4,548	3·6	163
FOWLER, T. W., Pittsworth (A.I.S., 5).						
Kenstan Vision 2nd	Alfa Vale Mindful	J.2	273	5,171	4·2	220
Kenstan Sunbeam	Alfa Vale Mindful	J.2	273	7,143	4·0	287
Kenstan Norma 2nd	Alfa Vale Mindful	S.2	273	7,592	4·6	352
Kenstan Model	Alfa Vale Mindful	S.2	273	7,887	4·4	317
Kenstan Kitty	Fairvale Janitor	S.2	273	7,896	4·2	331
HARCH, E., Laidley (A.I.S., 3).						
Newhaven Blossom 2nd	Blacklands Enthusiast	S.3	273	6,291	3·9	247
Newhaven Jean	Blacklands Enthusiast	S.3	273	6,202	4·0	246
Trevlac Spotted Rose	Valera Handsome's Perfection	J.2	273	4,294	4·3	184
HARVEY, C. and B. E. C., Nobby (A.I.S., 4).						
Mt. Camp Fuschia 12th	Rosenthal Douglas	S.2	240	5,679	4·0	227
Mt. Camp Scarlet 4th	Rosenthal Douglas	S.3	240	6,075	4·0	245
Yevrah Iris	Trevor Hill Skipper	J.2	273	5,825	3·8	224
Yevrah Ann	White Park Prince Royal	J.2	273	4,407	4·7	208

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
HEADING, C. A., Maleny (A.I.S., 7).						
Wilga Plains Poppy 8th	Blacklands Fairy Lad	J.2.	273	3,794	3·8	145
Wilga Plains Necklace 3rd	Headlands Red Jacket	M	273	6,639	4·5	299
Wilga Plains Bangle	Headlands Red Jacket	M	273	5,832	4·1	251
Wilga Plains Fussy 10th	Highfields Champion	J.2	240	6,117	3·9	242
Wilga Plains Ruby 21st	Highfields Rocket	S.3	273	5,340	3·8	190
Wilga Plains Ruby 14th	Wilga Plains Peter	M	273	7,240	3·5	256
Wilga Plains Daisy Bell 3rd	Wilga Plains Peter	M	273	5,914	4·3	254
HENRY, K., Greenmount (A.I.S., 9).						
Tara Cleo 4th	Alfa Vale Plumber	M	240	6,765	4·0	271
Tara Hilda 4th	Alfa Vale Plumber	J.2	273	6,219	3·8	239
Tara Hilda 5th	Bileena Bonnie's Prince	J.2	273	5,652	3·9	220
Tara Daphne 6th	Fairfield Maxwell	J.2	240	4,269	4·0	172
Tara Isis 10th	Fairfield Maxwell	S.2	273	6,791	4·7	317
Tara Hilda 6th	Fairfield Maxwell	S.2	273	6,677	4·0	270
Tara Elfin 8th	Fairfield Maxwell	S.2	273	5,396	4·4	237
Tara Elfin 9th	Tara Favo	S.2	120	2,763	3·9	107
Tara Cleo 3rd	Tara Magnets' Gift	M	240	7,200	4·5	327
HENSCHELL, W., Yarranlea (A.I.S., 18).						
Fairvale Laurel 2nd	Bingleigh Jean's Monarch	M	273	16,095	4·0	645
Yarranvale Judy 3rd	Blacklands' Roosevelt	J.2	150	2,676	4·2	112
Yarranvale Minerva 4th	Fairvale Cheerio	S.3	273	7,007	4·4	306
Yarranvale Jellicoe's Minerva 6th	Fairvale Jellicoe	J.2	273	6,104	3·7	253
Yarranvale Ethel 2nd	Fairvale Jellicoe	J.2	273	4,509	4·8	210
Yarranvale Gem	Fairvale Jeweller	J.2	273	8,138	4·2	344
Yarranvale Pretty Maid	Fairvale Jeweller	J.2	210	3,465	4·5	157
Trevor Hill Noella	Fairvale Jeweller	S.2	273	8,191	4·2	157
Trevor Hill Rosemary	Fairvale Jeweller	S.2	240	6,063	4·6	281
Yarranvale Handsome	Fairvale Jeweller	J.4	240	8,046	4·2	339
Yarranvale Minerva 3rd	Fairvale Jeweller	J.4	210	7,473	4·4	330
Fairvale Jean 15th	Fairvale Red Prince	M	240	6,213	4·5	281
Fairvale Minerva 5th	Fairvale Reward	M	210	6,504	4·0	257
Fairvale Dulcie 5th	Fairvale Reward	M	210	5,085	4·0	205
Yarranvale Model 6th	Fairvale Viceroy	S.4	150	3,309	4·0	132
Yarranvale Picture	Sunny View National	M	273	9,185	4·2	386
Yarranvale Jean	Trevor Hill Bosca	M	210	6,402	4·3	278
Yarranvale Flower	Yarranvale Prospector	M	240	9,396	4·2	394
JACKSON, E. W., Nobby (A.I.S., 5).						
Ennismore Fussy 2nd	Ardelia Ossie	M	273	5,732	4·8	278
Ennismore Ruby 2nd	Arolla Limerick	J.2	273	6,322	4·0	253
Ennismore Princess 2nd	Arolla Limerick	J.2	273	6,284	3·7	231
Ennismore Bud 5th	Arolla Limerick	J.2	273	4,832	4·0	195
Ennismore Fussy 4th	Arolla Limerick	M	273	5,166	3·9	203
KNIGHT, R. J., Biddeston, (A.I.S., 8).						
Barkworth Kitty	Roxmoor Lincoln	J.2	273	7,326	3·9	284
Barkworth Lyle	Roxmoor Lincoln	J.2	273	6,088	4·3	261
Barkworth Dahlia	Roxmoor Lincoln	J.2	273	6,408	3·9	251
Barkworth Betsy	Roxmoor Lincoln	J.2	273	3,905	6·3	244
Barkworth Amy	Roxmoor Lincoln	J.2	273	6,052	3·9	236
Barkworth Honey	Roxmoor Lincoln	J.2	273	5,599	4·1	227
Barkworth Evie	Roxmoor Lincoln	J.2	273	3,820	4·3	165
Barkworth Wendy 2nd	Roxmoor Lincoln	S.2	273	6,686	3·9	261
LESTER, M. C., Warwick (A.I.S., 12).						
St. Andrews Violet	Bingleigh Premier	M	273	10,125	4·4	442
St. Andrews Gentle 15th	Fairvale Ensign	J.2	273	6,573	3·9	257
Mountain Home Envy 3rd	Fairvale Ensign	M	240	11,814	4·2	493
St. Andrews Envy 2nd	St. Andrews Victory 13th	J.2	273	6,230	3·9	245
St. Andrews Violet 7th	Tabbagong Victory	J.2	273	6,628	4·9	323
St. Andrews Gentle 10th	Tabbagong Victory	S.2	273	6,054	4·2	258
St. Andrews Gentle 7th	Tabbagong Victory	S.2	180	4,158	4·9	205
St. Andrews Honeycombe 3rd	Tabbagong Victory	J.3	273	10,695	4·1	442
St. Andrews Gem 28th	Tabbagong Victory	J.3	210	6,519	4·0	260
St. Andrews Gentle 9th	Tabbagong Victory	J.3	240	9,282	4·1	383
St. Andrews Envy	Tabbagong Victory	S.3	273	11,768	3·9	460
St Andrews Olive	Tabbagong Victory	S.4	273	10,679	4·1	441
LOHSE, A., Degilbo (A.I.S., 4).						
Sunnyview National Lady 3rd	Newstead Ambassador	J.4	273	6,709	4·3	292
Alascan Plush	Sunnyview Ruby's Elect	J.3	273	5,756	4·1	238
Alascan Bess 3rd	Sunnyview Toy	S.2	273	8,248	4·3	352
Alascan Bess 2nd	Sunnyview Toy	S.2	273	6,672	4·5	300

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
McLENNAN, T., Willowvale, *via* Warwick (A.I.S., 7).						
Murcott Nancy 7th	Fairthorn Rainbow's Prince	J.2	273	5,029	4·0	199
Murcott Charm 6th	Fairthorn Rainbow's Prince	J.2	273	5,047	3·8	192
Murcott Clara 13th	Fairthorn Rainbow's Prince	J.2	273	3,726	3·7	139
Murcott Clara 11th	Murcott Royal	J.2	273	5,504	4·1	226
Murcott Petunia 5th	Murcott Royal	J.2	273	5,299	3·8	202
Murcott Nancy 6th	Murcott Royal	J.3	210	4,305	4·0	173
Murcott Clara 3rd	Rozana Red Radiance	M	273	8,104	4·0	199
MITCHELL AND MULCAHY, Warwick (A.I.S., 11).						
Fairlie Cherry 21st	Corunna Potentate	M	273	7,250	4·3	313
Rosenthal Fuchsia 30th	Rosenthal Enterpirse	J.2	273	8,159	3·8	312
Rosenthal Choice 28th	Rosenthal Enterprise	J.2	273	5,996	4·1	247
Rosenthal Princess	Rosenthal Enterprise	S.2	273	6,463	3·9	250
Rosenthal Lilac 23rd	Rosenthal Gay Knight	J.4	273	7,032	3·8	266
Rosenthal Choice 29th	Waraghai Trafalgar	J.2	273	7,618	3·9	298
Rosenthal Choice 29th	Waraghai Trafalgar	J.2	305	8,226	4·0	325
Rosenthal Lilac 31st	Waraghai Trafalgar	J.2	273	7,024	3·6	250
Rosenthal Fuchsia 21st	Waraghai Trafalgar	J.3	273	5,401	3·9	213
Rosenthal Lilac 26th	Waraghai Trafalgar	J.3	273	8,350	3·8	317
Rosenthal Choice 26th	Waraghai Trafaglar	J.3	273	6,153	3·6	223
Rosenthal Lilac 27th	Waraghai Trafalgar	J.3	273	5,287	4·0	213
NEALE, D. J., Pittsworth (A.I.S., 1).						
Alfa Vale Florrie 13th	Penrhos Pansy's Pride	J·2	273	4,660	4·3	198
O'SULLIVAN, CON, Greenmount (A.I.S., 9).						
Swanlea Diana 14th	Alfa Vale Loyal	M	273	14,366	3·8	549
Navillus Charm 17th	Greyleigh Eros	M	273	11,655	3·6	422
Navillus Charm 18th	Greyleigh Eros	M	273	9,951	3·5	352
Meadowstream Gem 2nd	Greyleigh Quality	J.3	273	6,946	4·0	278
Brundah Tulip 2nd	Navillus Radiant	J.2	273	7,047	3·8	267
Brundah Briar 2nd	Navillus Radiant	S.2	273	7,563	3·8	288
Brundah Sally 2nd	Navillus Radiant	S.2	273	6,934	3·5	244
Brundah Fairy 2nd	Navillus Radiant	M	273	7,565	4·3	330
Brundah Dulcy 2nd	Navillus Radiant	M	273	7,266	3·5	256
POWER, M. F., Kapaldo (A.I.S., 1).						
Wattleview Countess 22nd	Fairholm Gilpin	J.2	120	1,488	3·6	54
Q.A.H.S. and COLLEGE, Lawes (A.I.S., 11).						
College Raceme 6th	Alfa Vale Pride 3rd	M	273	7,976	3·9	309
College Dizzy 2nd	Alfa Vale Pride 3rd	S.4	273	6,800	4·4	297
College Pursue's Rascal	Alfa Vale Pursue	J.3	273	7,500	4·1	309
College Pursue's Thorn	Alfa Vale Pursue	S.2	273	6,737	4·1	276
Ennismore Ruth 3rd	Arolla Limerick	J.4	273	9,553	3·4	321
Bingleigh Laurel	Blacklands Arbitrator	S.2	273	7,694	3·9	302
Bingleigh Pretty Maid	Blacklands Jean's Victory	J.2	273	9,551	4·1	397
Bingleigh Dahlia	Blacklands Jean's Victory	S.2	273	8,302	4·0	336
Bingleigh Miss Ettie 5th	Blacklands Jean's Victory	J.3	273	8,257	3·7	309
Bingleigh Miss Ettie 5th	Blacklands Jean's Victory	J.3	305	8,693	3·8	330
Bingleigh Myrtle 3rd	Blacklands Jean's Victory	M	273	10,172	4·3	432
Bingleigh Myrlte 3rd	Blacklands Jean's Victory	M	305	10,619	4·3	452
College Presidents Ivy	Ennismore President	J.2	273	8,224	3·4	282
RUHLE, K. A., Motley, *via* Oakey (A.I.S., 4).						
Motley Valley Pet	Fairvale Patriot	J.3	210	4,425	5·8	258
Yarranvale Dolly	Fairvale Viceroy	S.4	150	3,456	4·9	169
Invercaull Dainty 2nd	Glenvale Park Prince 2nd	J.2	210	3,210	4·7	151
Blacklands Queen 39th	Parkview Arbitrator	J.2	120	2,535	3·9	99
SANDERSON, W., Mulgeldie (A.I.S., 9).						
Logie Bank Dainty 42nd	Montlea Curly	J.2	273	5,644	3·8	216
Logie Bank Ruby 18th	Parkview Talisman	J.2	273	6,305	4·1	259
Sunlit Farm Gem 2nd	Sunlit Farm King Billy	J.2	273	5,710	3·8	217
Sunlit Farm Roseline 11th	Sunlit Farm King Billy	S.2	273	6,618	4·0	267
Sunlit Farm Alice 5th	Sunlit Farm Madam's Victory	J.2	273	6,570	4·0	263
Sunlit Farm Victory's Ida	Sunlit Farm Madam's Victory	J.2	273	6,041	4·0	240
Sunlit Farm Ivy 3rd	Sunlit Farm Madam's Victory	J.2	273	6,139	3·8	233
Sunlit Farm Flower 12th	Sunlit Farm Madam's Victory	J.2	273	4,997	4·1	206
Sunlit Farm Poppy 7th	Sunlit Farm Madam's Victory	S.2	273	7,832	3·7	295

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
SCOTT, W. and A. G., Blackbutt (A.I.S., 8).						
alena Gwen 2nd	Arley Chieftan	S.2	180	1,996	4·3	87
alena Tiny Girlie 2nd	Arley Chieftan	S.2	60	1,113	4.5	50
dar Grove Ellen 49th ..	Cedar Grove Count	S.2	273	4,021	4·2	170
ilga Plains Ruby 10th ..	Highfield Guardsman	M	273	6,634	3·7	247
rora Fortune	Parkview Challenge	J.2	210	4,302	3·7	158
rora Joan 2nd	Parkview Challenge	S.3	30	903	3·8	34
rora Luana 2nd	Parkview Challenge	S.4	273	4,546	4·2	191
nesley Rosy 11th	Valera Daphne's Pride	S.2	273	7,372	3·9	291
nesley Rosy 11th	Valera Daphne's Pride	S.2	305	7,934	3·9	312
SKERMAN, I. B., Kaimkillenbun (A.I.S., 18).						
guna Venus 5th	Alfa Vale Brigadier	M	273	9,419	3·9	369
versham Gem 3rd	Chelmer Redman	M	240	7,449	4·2	316
versham Gem 11th	Girraween Gideon	S.3	273	7,431	4·2	312
irvale Iris	Fairvale Reward	M	273	8,984	4·0	363
ola Sweet Briar 3rd	Navillus Plumdale	J.4	240	7,692	4·5	343
ola Rose	Navillus Vera 3rd's Re Nell ..	M	273	8,010	4·3	341
ppley Park Flower 10th ..	Mountain Camp Joker	J.2	273	6,057	3·8	232
ppley Park Thelma 3rd ..	Mountian Camp Joker	J.2	273	4,764	3·8	183
ppley Park Shannon 5th ..	Mountain Camp Joker	J.2	273	4,680	4·0	190
ppley Park Thelma 4th ..	Mountain Camp Joker	S.2	273	5,588	3·9	218
ppley Park Dainty 3rd ..	Mountain Camp Joker	S.2	273	4,980	3·7	184
ppley Park Iris 3rd	Mountain Camp Joker	S.2	240	3,882	3·9	153
ppley Park Melba 3rd ..	Mountain Camp Joker	J.3	240	6,525	5·0	256
ppley Park Thelma 2nd ..	Mountain Camp Joker	J.3	273	6,501	3·9	255
ppley Park Melba 4th ..	Mountain Camp Joker	S.3	273	5,802	3·9	224
ppley Park Rosebud 7th ..	Mountain Camp Joker	S.3	273	5,792	3·4	199
ppley Park Thistle 7th ..	Trevor Hill Reflection	S.3	273	7,456	4·1	305
ppley Park Doris	Trevor Hill Reflection	J.4	240	8,568	3·7	318
SPERLING, G., Kooralgin, *via* Yarraman (A.I.S., 9).						
ooravale Fairy	Alfa Vale Princely	J.2	273	5,756	4·3	249
acklands Melba 23rd	Blacklands Gloucester	S.4	273	7,407	3·9	292
. Andrews Gem 35th	Fairvale Ensign	J.2	273	6,788	3·9	263
ighfields Perfect 42nd	Highfields Starlight	M	273	7,725	3·8	294
ighfields Connie 7th	Laguna Emblem 8th	M	240	6,101	3·4	206
enrhos Nancy 14th	Penrhos Archie	M	273	7,422	3·9	287
enrhos Shiela 21st	Rosenthal Lochinvar	J.3	273	6,614	4·0	262
enrhos Evelyn 18th	Rosenthal Macarthur	J.4	240	5,565	3·3	184
. Andrews Gem 4th	Tabbagong Victory	J.2	273	3,993	4·1	162
SULLIVAN, D., Pittsworth (A.I.S., 13).						
antry Choice 5th	Bantry Commodore	J.4	240	4,083	4·4	179
antry Bonnie 2nd	Bantry Commodore	S.4	240	4,704	4·1	193
antry Rosebud 2nd	Bantry Nancy's Prince	J.2	273	5,554	4·7	260
antry Model 5th..	Bantry Nancy's Prince	J.2	210	4,836	4·4	215
antry Rose 6th	Bantry Nancy's Prince	J.2	210	2,958	4·4	129
antry Bonnie 5th	Bantry Nancy's Prince	S.2	273	5,738	3·8	220
antry Nancy	Bantry Nancy's Prince	S.2	273	4,692	4·3	200
antry Nellie 2nd	Rosenthal Surplus 2nd	M	273	6,374	3·8	243
antry Model 6th..	Valera Justice	J.2	273	6,120	4·5	275
antry Lila 3rd	Valera Justice	J.2	273	5,173	4·9	255
antry Bonnie 6th	Valera Justice	J.2	273	5,772	4·0	225
antry Bonnie 7th	Valera Justice	J.2	120	1,500	4·3	64
antry Bonny 8th	Valera Justice	S.2	150	2,403	4·5	108
SULLIVAN BROS., Pittsworth (A.I.S., 15).						
alera Una 12th	Alfa Vale Pride 2nd	J.2	273	8,114	4·1	333
alera Jean 2nd	Alfa Vale Pride 2nd	J.2	273	8,221	3·9	322
alera Jean 2nd	Alfa Vale Pride 2nd	J.2	305	8,665	3·9	341
alera Dahlia 2nd	Alfa Vale Pride 2nd	J.2	273	7,422	4·3	319
alera Roseleaf 32nd	Alfa Vale Pride 2nd	J.2	273	6,738	4·5	302
alera Roseleaf 35th	Alfa Vale Pride 2nd	J.2	273	6,663	4·5	301
alera Judy 3rd	Alfa Vale Pride 2nd	J.2	273	6,627	4·4	294
alera Bonnie 18th	Alfa Vale Pride 2nd	J.2	273	6,433	4·0	257
alera Dahlia 3rd..	Valera Monarch	J.2	273	6,791	4·3	293
alera Roseleaf 37th	Valera Monarch	J.2	273	5,636	4·1	229
alera Handsome 9th	Valera Monarch	J.2	240	4,575	4·2	193
alera Thelma	Valera Renown	J.2	273	6,269	3·6	228
alera Bonny 19th	Valera Roseleaf's Reflection ..	J.2	273	6,136	4·1	254
alera Sally 10th	Valera Roseleaf's Reflection ..	J.2	273	6,043	4·2	254
alera Lila 29th	Valera Roseleaf's Reflection ..	J.2	273	4,858	4·9	237
alera Pendant 8th	Valera Roseleaf's Reflection ..	S.2	273	7,734	3·6	284
WEBSTER, A. H., Helidon (A.I.S., 3).						
illievale Olive 3rd	Millievale Hector	S.2	240	5,889	4·3	254
evor Hill Moya	Fairvale Jeweller	J.2	240	5,832	4·1	242
illievale Aster 2nd	Fairvale Supreme	J.2	240	5,460	4·6	251

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter fat.
				Lb.	%	Lb.
WOODFORD, A. P., Kapaldo (A.I.S., 2.)						
Croydon Flower 5th	Alfa Vale Lombard,	J.2	273	6,517	3·7	244
Applegarth Prim 4th	Greyleigh Crowner	M	273	7,402	3·8	284
YOULES, R. J. E., Kilcoy (A.I.S., 8).						
Bingleigh Molly 16th	Blacklands Emblem	M	210	5,757	3·9	224
Glen Idol Jenny 15th	Blacklands True Blue	J.4	273	6,579	3·7	246
Winyalea Molly	Chelmer Red Prince	J.2	273	6,113	4·4	266
Beriley Minature	Chelmer Red Prince	J.2	240	3,549	4·4	157
Winyalea Rosalie	Happy Hill Lauretta's Pride	J.2	210	3,270	4·3	142
Winyelea Lauretta	Happy Hill Lauretta's Pride	S.2	273	6,628	4·5	298
Greenlea Midge 2nd	Malbreen Robin 2nd	M	273	6,345	3·6	330
Kapleton Maiden	Rhodesview Royal Lad	M	273	9,621	3·9	372
AYRSHIRE.						
DUDGEON, C. E. R., Maleny (Ayrshire, 3).						
Jenola Daphne	Auchen Eden Buster	S.2	273	5,205	3·9	201
Denbigh Gentle 64th	Denbigh Opportune	J.2	120	2,379	3·6	85
Auchen Eden Butterfly 2nd	Oatlands Duke	J.2	273	5,240	3·9	202
MANN, N. J., Broxburn, *via* Pittsworth (Ayrshire, 9).						
Leafmore Honor Royal	Burwood Royal Master 2nd	J.2	273	7,583	3·8	287
Crescent Farm Joycey 2nd	Crescent Farm Bell Boy	J.2	273	7,517	3·7	280
Crescent Farm Isobel 4th	Crescent Farm Bell Boy	J.2	273	6,822	3·8	261
Crescent Farm Lady Isobel	Crescent Farm Bell Boy	S.2	273	6,897	3·6	249
Crescent Farm Heiress	Horsley Ayr Lad	J.2	273	6,723	4·1	277
Leafmore Lydia	Leafmore Paul	J.3	273	6,616	3·7	244
Leafmore Hoaker 2nd	Myola Jaunt 2nd	J.2	273	6,791	4·1	282
Crescent Farm Peacefulness	Myola Orphan Boy	M	273	8,851	3·7	329
Crescent Farm June 2nd	Myola Orphan Boy	M	240	6,192	3·7	231
MATHIE, E. and SONS, Maleny (Ayrshire, 7).						
Ainslie Audrey	Ainslie Reliance	J.2	240	5,667	4·4	251
Ainslie Rita	Ainslie Reliance	S.2	273	6,905	3·9	273
Ainslie Peggy	Ainslie Reliance	S.2	273	5,682	4·6	260
Ainslie Ladybelle	Ainslie Reliance	J.4	273	7,081	4·2	298
Ainslie Alison	Crescent Farm Joy Boy	J.2	273	6,159	4·1	253
Ainslie Lovely	Crescent Farm Joy Boy	S.4	240	8,598	4·2	363
Ainslie Rena	Crescent Farm Milkboy	J.2	273	7,229	4·1	293
NOBLE, H. R., Wanora, *via* Ipswich (Ayrshire, 7).						
Auchen Eden Mudlark	Auchen Eden Terryle	J.2	273	5,670	4·0	226
Crescent Farm Miss Tulip	Crescent Farm Bell Boy	S.2	273	7,156	3·8	270
Crescent Farm Monnie's Pride	Crescent Farm Bell Boy	S.2	180	3,867	3·8	146
Auchen Eden Blue Bell	Fairhill Buddy	S.2	273	5,426	4·2	231
Auchen Eden Lady Lindy	Oatlands Duke	S.2	273	7,001	3·6	251
Auchen Eden Briar	Oatlands Duke	J.3	273	5,981	4·0	241
Auchen Eden Honeysuckle	Oatlands Duke	S.3	240	5,742	3·8	220
NORGAARD, L. and N., Nara, *via* Oakey (Ayrshire, 4).						
Holm Park Melba 6th	Beltana Judy's Joss	J.2	273	3,725	4·5	167
Holm Park Miriam	Beltana Judy's Joss	S.2	273	5,765	4·1	238
Holm Park Jaunty	Myola Jaunty's Prince	J.2	273	7,332	4·8	354
Holm Park Jollity 2nd	Myola Jellicoe 2nd	S.3	273	8,095	3·5	283
RUHLE, J. P., Motley, Oakey (Ayrshire, 12).						
Leafmore Bernadette	Burwood Royal Master 2nd	J.2	273	5,138	4·6	237
Leafmore Gail	Burwood Royal Master 2nd	J.2	273	5,355	4·3	230
Leafmore Harriet 2nd	Leafmore Grisha	M	210	5,514	3·6	198
Leafmore Beryl's Pride	Leafmore Paul	J.2	273	3,385	4·1	140
Leafmore Bonnie Nell	Myola Bessemer	M	273	6,580	3·9	260
Leafmore Tidy Talmadge	Myola Bessemer	M	210	6,162	4·1	253
Leafmore Honor 2nd	Myola Bessemer	M	273	4,881	4·7	231
Leafmore Lynn	Myola Juggler	J.2	273	6,932	3·6	262
Leafmore Miss Dove	Myola Juggler	M	273	5,748	4·8	274
Leafmore Silver	Myola Perfection	J.2	273	5,078	4·1	208
Leafmore Mist	Myola Perfection	J.2	273	5,134	3·7	188
Leafmore Lady Gay	Myola Perfection	S.2	273	6,307	3·9	246
ST. CHRISTOPHER'S LODGE, Brookfield (Ayrshire, 4).						
Iona Jolly 4th	Glen Muir Peter	J.3	273	7,188	4·0	284
Iona Joy 3rd	Glen Muir Peter	J.3	273	6,465	4·1	267
Iona Garnet	Leafmore Victory	J.2	273	4,759	4·2	201
St. Christopher's Topsy	Myola Jaunty's Prince	M	273	5,649	4·4	251

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
SCOTT, J. N., Camp Mountain (Ayrshire, 8).						
Auchen Eden Thistledown	Auchen Eden Archibald	S.3	273	7,977	4·5	361
Auchen Eden Thalia	Auchen Eden Rajah	M	273	8,760	4·9	430
Auchen Eden Buddy's Joy	Fairhill Buddy	S.2	273	6,840	5·4	371
Auchen Eden Marcia	Oatlands Duke	J.2	273	6,831	5·0	340
Auchen Eden Trixie 2nd	Oatlands Duke	S.2	273	10,680	4·8	511
Auchen Eden Trixie 2nd	Oatlands Duke	S.2	305	11,516	4·8	554
Auchen Eden Trixie 2nd	Oatlands Duke	S.2	365	12,986	4·9	635
Auchen Eden Margie	Oatlands Duke	S.2	273	8,780	4·7	412
Auchen Eden Margie	Oatlands Duke	S.2	305	9,503	4·7	448
Auchen Eden Margie	Oatlands Duke	S.2	365	10,921	4·7	517
Auchen Eden Butterscotch	Oatlands Duke	J.2	273	7,461	4·4	325
Auchen Eden Trude	St. Christopher's Marquis	J.4	273	7,199	4·7	348
STIMPSONS LTD., Loganlea (Ayrshire, 3).						
Eleresley Cynthia 2nd	Auchen Eden Miracle	M	180	5,328	4·3	229
Eleresley Bright Eyes	Oatlands (Q.) Dan	J.2	273	5,927	4·5	270
Eleresley Flirt 5th	Oatlands (Q.) Dan	S.4	273	8,144	4·6	374
FRIESIANS.						
GORDON, Dr. D., Oxley (Friesian, 7).						
Glendalough Maida 10th	Anama Wodan Jan	J.3	273	6,916	4·3	298
Glendalough Corndale 15th	Anama Wodan Jan	S.3	273	5,473	4·1	227
Burnbrae Myra Colantha	Burnbrae Moira's Pietje	J.3	273	7,988	3·9	313
Glendalough Cissy	Burnbrae Victory Vaallveeman	S.2	273	8,333	3·6	304
Brigalow Dutchmaid 16th	St. Athans Bell Piebe 2nd	J.2	273	5,578	3·5	198
Brigalow Belle	St. Athans Bell Piebe 2nd	S.2	273	7,839	3·5	277
Burnbrae Adeline Colantha	Wattlebank Colantha Auklod	S.3	273	9,069	3·7	339
NAUMANN, C. H., Yarraman (Friesian, 9).						
Rockview Fanny	Anama Transvaal Stamp	J.3	273	6,913	3·3	230
Rockview Beauty	Burnbrae Pontiac Piebe	M	273	8,101	3·2	256
Brigalow Dutchmaid 8th	Invale Friesland Chief	M	273	8,187	3·5	289
Yarrabine Molly's Robe	Rockview Clinker	J.2	273	7,015	3·6	251
Yarrabine Gypsy Princess	Rockview Clinker	J.2	273	7,107	3·4	244
Yarrabine Oak Beauty	St. Athans Oak Eagle	J.2	273	6,086	3·4	204
Yarrabine Bonny Angel	St. Athans Oak Eagle	J.2	273	5,312	3·3	175
St. Athans Vic Olive 2nd	Victoria Eagle	M	273	11,312	3·0	337
St. Athans Vic Darling	Victoria Eagle	M	273	9,725	3·2	311
GUERNSEY.						
BROOKS AND SONS, Bauple (Guernsey, 10).						
Linwood Chance	Laureldale Baron	M	273	4,887	3·8	184
Adaville Freezia	Laureldale Lifebouy	J.2	273	3,458	4·6	159
Adaville Gloria	Laureldale Lifebouy	J.2	273	3,073	5·0	153
Adaville Fuchsia	Laureldale Roseboy	M	210	3,438	4·2	144
Adaville Fussy	Laureldale Pluto	M	273	4,082	4·7	191
Adaville Gwenda	Laureldale Pluto	M.	210	3,246	4·2	137
Linwood Finch	Linwood Peter	M	273	4,293	4·4	190
Linwood Gloss	Warrawong Winter	M	273	4,499	4·2	187
Linwood Shammy	Warrawong Winter	M	210	4,020	4·1	164
Adaville Gem	Willowbrae Victory	M	240	4,176	3·6	151
COOKE, J. M., Maleny (Guernsey, 1).						
Adaville Coral	Willowbrae Victory	J.3	240	4,671	4·7	220
COOKE, W. A. K., Maleny (Guernsey, 6).						
Laureldale Ethel 4th	Bangalow Vale Guardsman	J.2	273	5,290	4·6	241
Laureldale Vida 4th	Bangalow Vale Guardsman	S.2	273	4,443	4·5	201
Laureldale Duchess 3rd	Bangalow Vale Guardsman	J.3	273	5,395	4·6	249
Laureldale Jill	Laureldale President	M	273	6,763	4·1	277
Laureldale Liddy	Minnimurra Topsy's Sequel 2nd	M	273	8,267	4·7	388
Laureldale Pamela	Minnimurra Topsy's Sequel 2nd	M	273	6,919	4·6	315
CRANNEY, A. J., Maleny (Guernsey, 5).						
Fernhill Fairy Duchess	Wollongbar Remus	J.2	273	4,762	5·6	268
Fernhill Babe	Wollongbar Remus	J.2	273	4,860	5·1	250
Fernhill Mariette	Wollongbar Remus	J.2	273	3,550	6·0	214
Fernhill Glitter	Wollongbar Remus	J.2	273	3,365	6·1	206
Fernhill Jennifer	Wollongbar Remus	J.3	273	6,695	4·9	331
DOSS, W. H., Degilbo (Guernsey, 4).						
San Jonda Fairy	Fairfield Winner	J.2	273	4,370	4·7	207
Oakwood Honour 2nd	Fairfield Winner	J.4	273	5,315	4·8	256
San Jonda Beatrix	Laureldale Pride	J.2	273	3,487	5·2	183
San Jonda Brighteyes	Laureldale Pride	S.2	273	6,320	5·1	320

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter fat.
				Lb.	%	Lb.
FOXTON, E. G., Maleny (Guernsey, 15).						
Toba Sarah	Koojan Ace's Marshall	J.4	273	5,873	4·5	262
Toba Sue	Koojan Spellbound	J.2	273	4,075	5·5	223
Toba Herione	Linwood Hurricane	J.2	273	5,125	4·7	243
Toba Olwyn	Linwood Hurricane	J.2	273	4,486	4·6	205
Toba Generous	Linwood Hurricane	S.2	273	5,788	4·3	247
Toba Secret	Linwood Hurricane	S.3	273	5,344	4·9	261
Toba Olga	Linwood Hurricane	J.4	273	6,314	4·6	293
Toba Beauty	Linwood Hurricane	S.4	273	6,507	4·5	292
Willow Brae Poppy	Linwood Peace Boy	M	273	8,666	4·6	396
Willow Brae Poppy	Linwood Peace Boy	M	305	9,273	4·6	424
Willow Brae Poppy	Linwood Peace Boy	M	365	10,309	4·6	474
Toba Favourite	Toba Batten	J.2	273	6,332	4·1	261
Toba Socks	Toba Ding Dong	J.2	273	4,677	4·7	220
Toba Polly	Toba Ding Dong	S.2	273	4,764	4·7	225
Toba Marie	Warrawong Winter	S.4	273	7,838	4·2	327
Linwood Delight	Warrawong Winter	M	273	6,886	4·9	300
Linwood Gay Lady	Warrawong Winter	M	273	7,660	4·2	324
MURDOCK AND WRIGLEY, Preston, *via* Toowoomba (Guernsey, 6).						
Evermore Queen Ann	Evermore Trump	M	273	4,679	5·0	233
Evermore Merl	Yarraview Commander	M	240	5,547	5·1	286
Evermore Maytime	Yarraview Commander	M	240	5,274	4·9	257
Evermore Tess	Yarraview Commander	M	240	4,440	5·6	249
Evermore Josie 3rd	Yarraview Commander	M	210	3,774	4·8	182
Preston May	Yarraview Imperial	S.3	273	5,126	4·3	218
RUGE, A. AND SONS, Woowoonga, *via* Biggenden (Guernsey, 14).						
Willowbrae Tossels	Laureldale Don	J.3	273	6,507	5·1	332
Willowbrae Trilby	Laureldale Don	S.3	273	7,831	5·0	391
Laureldale Vera 2nd	Laureldale Prospect	J.3	273	6,324	4·7	298
Willowbrae Daffodil	Linwood Pharos	J.4	273	9,421	4·7	439
Springvale Jennifer	Moongi Gay Sport	J.4	273	7,961	4·4	353
Springvale Topsy	Moongi Lloyd George	J.3	273	6,118	4·6	281
Springvale Verla	Moongi Lloyd George	S.3	273	8,286	4·9	407
Springvale Jessie	Moongi Lloyd George	J.4	273	9,068	4·1	368
Woowoonga Jubilee	Springvale Lancelot	J.2	273	7,565	4·5	339
Woowoonga Flossie	Springvale Lancelot	J.2	273	5,852	4·8	281
Woowoonga Clementine	Springvale Lancelot	J.2	273	5,547	4·7	263
Springvale Cordelia	Springvale Lancer	J.2	273	4,365	4·7	203
Springvale Elva	Springvale Governor	J.2	273	5,717	4·9	279
Springvale Lucienne	Springvale Governor	J.2	273	5,105	4·8	247
SENTINELLA, E. C., Graceville (Guernsey, 4).						
Darinth Park Betty	Fernhill Searchlight	J.4	273	8,008	4·1	327
Tattenbar Nerida	Linwood Peer	M	273	7,335	4·7	341
Tattenbar Ollie	Linwood Peer	M	273	8,187	4·7	388
Tattenbar Neta	Linwood Peer	M	273	6,685	4·6	309
STRACHAN, A. W., Oxley (Guernsey, 2).						
Oxley Pearl	Moongi Veronica's Tony	S.2	240	2,706	4·8	131
Avalon Style	Moongi Veronica's Tony	S.4	273	3,970	5·0	200
JERSEY.						
AHERN, J., Conondale, *via* Maleny (Jersey, 8).						
Connemara Creole Betty	Belgonia Flashlight	S.2	273	5,104	5·6	284
Connemara Rosemary	Belgonia Flashlight	S.3	273	4,729	5·8	273
Connemara Princess Eileen	Devon Park Madiera's Victorious	J.2	273	4,473	5·9	263
Connemara Dainty Bridesmaid	Devon Park Madiera's Victorious	J.2	273	3,489	6·1	212
Navua Designing Fillpail	Navua Designing Ruler	S.3	240	3,420	5·0	171
Lermont Bud 4th	Trinity Graceful Duke	J.2	273	4,045	6·0	242
Brooklodge Erna	Trinity Mighty Prince	J.2	273	3,230	5·4	173
Brooklodge Sweet	Trinity Mighty Prince	M	240	6,426	4·9	314
ANDERSON, R. A., Yandina (Jersey, 2).						
Bonnie Brae White Daisy	Bonnie Bray Darby	M	240	3,048	4·5	137
Bonnie Brae Brown Maid	Bonnie Bray Monty	S.2	240	3,354	4·7	156
BAILEY, W., Greycliff, *via* Biloela (Jersey, 5).						
Romsey Flying Duchess	Oxford Flying Fox	J.3	240	4,224	4·5	192
Romsey Ginger Maid	Oxford Flying Fox	S.4	240	5,271	3·8	203
Ashendon Cowslip	Trecarne Jersey Boy	J.2	180	3,168	4·5	146
Ashendon Silver	Trecarne Jersey Boy	J.2	180	2,661	4·6	123
Valhalla Clover Leaf 4th	Valhalla Desmond	S.4	240	4,410	4·9	217

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butterfat.
				Lb.	%	Lb.
BARLOW, C. W. and E. M., Boodua, *via* Oakey (Jersey, 1).						
Erceldene Ecstasy	Erceldene Really Royal ..	J.2	240	3,360	5·5	186
BECKINGHAM, C., Everton Park, Brisbane (Jersey, 7).						
Goldland Daffodil	Calton Lotmyle	M	273	5,741	5·0	287
Lockerbie Bella	Gunawah Neptune	J.2	273	3,368	5·3	178
Danilo Beauty	Navua Designing Count 2nd ..	J.2	273	3,459	5·4	186
Cosme Harmony	Oxford Buttercup's Victory ..	J.2	273	4,229	5·5	231
Cosme Buttercup's Glory ..	Oxford Buttercup's Victory ..	J.2	273	4,187	5·3	223
Lockerbie Some Maiden	Trecarne Some Duke	S.3	240	3,819	5·3	204
Trecarne Jersey Miss 4th ..	Trecarne Some Duke	M	273	6,545	5·2	339
BORCHERT, Mrs. I. L. M., Kingaroy (Jersey, 25).						
Woodbine Dainty	Avon View Lord Pictine ..	M	240	4,884	4·8	237
Willow Bank Arabule's Pet ..	Brampton Doffodil's Peer ..	S.2	273	5,529	5·6	309
Willow Bank Arabule's Pet ..	Brampton Daffodil's Peer ..	S.2	305	6,046	5·7	347
Willow Bank Repeat	Brampton Daffodil's Peer ..	S.2	273	5,113	5·6	287
Willow Bank Audrey	Brampton Daffodil's Peer ..	S.2	273	4,002	5·5	219
Willow Bank Collett	Brampton Daffodil's Peer ..	S.3	273	4,821	5·4	262
Willow Bank Cute Poppy ..	Inverlaw Observer	J.2	273	6,317	4·9	309
Willow Bank Golden Queen ..	Inverlaw Observer	J.2	273	5,972	4·8	287
Willow Bank Powder	Inverlaw Observer	J.2	273	6,090	4·7	285
Willow Bank Powder	Inverlaw Ovserber	J.2	305	6,515	4·8	313
Willow Bank Attraction's Girl ..	Inverlaw Observer	J.2	273	5,417	5·1	276
Willow Bank Point	Inverlaw Observer	J.2	273	5,662	4·8	270
Willow Bank Pansy	Inverlaw Observer	J.2	273	4,704	5·3	251
Willow Bank Little Pet	Inverlaw Observer	J.2	273	4,827	5·3	258
Willow Bank Joyful Marion ..	Inverlaw Observer	J.2	273	3,404	5·1	177
Willow Bank Dairy Queen ..	Inverlaw Observer	J.2	210	3,274	5·1	167
Willow Bank Golden Bud ..	Inverlaw Obesrver	S.2	273	6,250	5·7	353
Willow Bank Gold Speck ..	Inverlaw Observer	S.2	273	4,470	5·7	256
Willow Bank Golden Drop ..	Inverlaw Observer	S.2	240	4,193	5·2	219
Willow Bank Princess Mary ..	Inverlaw Obesrver	S.2	273	5,282	4·6	245
Willow Bank Golden Wings ..	Inverlaw Observer	S.3	273	8,057	4·8	386
Willow Bank Promise	Inverlaw Observer	S.3	273	4,873	5·2	255
Trecarne Tottie's Queen	Trecarne Golden Lad 2nd ..	S.3	240	4,185	4·6	194
Trecarne Golden Ettlyn 2nd ..	Trecrane Peer 2nd	M	273	6,822	4·6	314
Trecarne Chiming 3rd	Trecarne Some Lad 3rd ..	S.2	273	9,169	5·4	499
Trecarne Chiming 3rd	Trecarne Some Lad 3rd	S.2	305	9,783	5·5	537
Trinity Golden Aim	Trinity Crowning Effort ..	J.4	273	4,217	5·2	218
Trinity National Lass	Trinity National Victory ..	J.3	273	5,680	4·9	278
BROWNE, R. J., Yangan, *via* Warwick (Jersey, 19.)						
Minidong Maid	Balwyn Fancy's Baron	M	273	6,353	6·1	385
Minidong Maid	Balwyn Fancy's Baron	M	305	6,707	6·1	407
Glenrandle Winsome Lady ..	Gem Rodney	S.3	273	4,232	6·3	265
Glenrandle Diana	Gem Rodney	S.3	273	3,993	5·3	212
Hill 60 Likeness 2nd	Kelvinside Dream Boy	J.2	273	4,676	5·4	253
Hill 60 Likeness 2nd	Kelvinside Dream Boy	J.2	305	5,012	5·4	273
Hill 60 Esteem	Kelvinside Dream Boy	J.2	273	4,996	4·6	229
Hill 60 Likeness	Kelvinside Dream Boy	J.3	273	7,974	4·7	379
Hill 60 Likeness	Kelvinside Dream Boy	J.3	305	8,366	4·8	400
Hill 60 Golden Thread	Kelvinside Dream Boy	S.4	273	8,009	4·0	319
Nairfale Coquette	Kelvinside Handsome Boy ..	M	240	7,371	5·6	410
Nairfale Chenille	Kelvinside Handsome Boy ..	M	273	6,441	4·8	308
Nairfale Sapphire	Kelvinside Handsome Boy ..	M	273	5,982	4·6	278
Nairvale Neat Neta	Nairfale Count's Paymaster ..	M	273	6,300	5·0	314
Nairfale Lena	Nairfale Golden Reality ..	M	273	7,245	4·9	356
Nairfale Lena	Nairfale Golden Reality ..	M	305	7,449	5·0	369
Nairfale Idol's Delight	Nairfale Golden Recorder ..	M	273	7,265	5·8	412
Nairfale Idol's Delight	Nairfale Golden Recorder ..	M	305	7,816	5·7	448
Nairfale Likeness	Nairfale Golden Recorder ..	M	273	7,485	4·6	343
Nairfale Gentle	Nairfale Golden Recorder ..	M	273	6,048	5·1	311
Nairfale Noble's Rosemary ..	Nairfale Prides' Noble	M	305	8,197	5·0	409
Nairfale Noble's Rosemary ..	Nairfale Pride's Noble	M	273	7,629	5·0	380
Valley Farm Nola	Navua Ethne's Royalist ..	M	273	9,712	4·7	456
Valley Farm Nola	Navua Ethne's Royalist ..	M	305	10,050	4·7	476
Glenrandle Cream Maid	Trinity Gleaming Effort ..	S.2	273	4,970	5·3	264
Glenrandle Daffodil 2nd	Trinity Gleaming Effort ..	J.3	273	7,225	4·8	346
BYGRAVE, P. J. L., Aspley, Brisbane (Jersey, 2).						
Navua Egretta 3rd	Elm Hill Volxenia Nobly Born	M	273	4,967	7·1	354
Craigan Cecelia's Queen	Navua Designing Count 2nd ..	J.2	240	3,369	5·2	176

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
CARPENTER, J. W., Helidon (Jersey, 9).						
Mayfair Charm 2nd	Mayfair Winston	S.2	273	4,459	4·7	211
Mayfair Bell	Trecarne Golden King 2nd	M	273	5,145	6·3	323
Mayfair Maybell	Trecarne Golden Lad 3rd	J.2	273	4,028	5·2	210
Mayfair Golden Lass	Trecarne Golden Lad 3rd	S.2	273	4,188	4·9	204
Mayfair Heatherbell 3rd	Trecarne Golden Lad 3rd	S.2	180	2,877	4·1	118
Mayfair Ettlyn	Trecarne Golden Lad 3rd	J.3	273	4,736	5·4	255
Mayfair Lady Gay 3rd	Trinity Crowning Admiral	J.3	273	5,308	5·7	301
Mayfair Lady Gay 4th	Woodview Some Commander	S.2	273	4,137	6·0	250
Mayfair Twinkle 2nd	Woodview Some Commander	S.2	273	4,415	5·5	245
COCHRANE, H., Kin Kin (Jersey, 6).						
Austral Park Blue Royal	Austral Park Blue Lad	J.3	273	3,081	5·5	170
Fauvic Florin	Austral Park Distinction	S.4	240	2,910	5·4	158
Fauvic Heroine	Baerami Douglas	J.4	273	3,683	5·6	205
Fauvic Respond	Fauvic Cornet	J.3	273	3,960	5·6	222
Fauvic Lace	Fauvic Cornet	S.3	273	3,229	5·6	182
Fauvic Promise	Fauvic Trial Link	J.4	273	4,633	5·7	263
COLVIN, J., Beechmont (Jersey, 16).						
Eumirvel Star Delight	Avon Real Star (Imp)	S.2	273	5,239	5·3	278
Eumirvel Star Perfection	Avon Real Star (Imp)	J.3	273	6,532	4·9	322
Eumirvel Star Maiden	Avon Real Star (Imp)	S.3	240	7,290	4·9	358
Eumirvel Star Jewel	Avon Real Star (Imp)	J.4	273	6,566	5·0	331
Eumirvel Neta	Eumirvel Beechmont Peer	M	210	7,761	5·2	405
Eumirvel Mariette	Eumirvel Beechmont Peer	M	273	5,664	5·5	313
Eumirvel Beechmont Peeress	Eumirvel Beechmont Peer	M	273	5,486	5·9	326
Eumirvel Nerida	Hunstrete's Galores Emperor 2nd	M	273	5,503	4·5	250
Eumirvel Goldie	Reflection's Golden Aim (Imp)	J.2	273	5,102	5·7	290
Eumirvel Maybelle	Reflection's Golden Aim (Imp)	J.2	273	4,907	5·7	282
Eumirvel Golden Nan	Reflection's Golden Aim (Imp)	J.2	273	4,855	5·4	264
Eumirvel Golden Lass	Reflection's Golden Aim (Imp)	J.2	273	4,742	5·4	256
Eumirvel Golden Duchess	Reflection's Golden Aim (Imp)	J.2	273	4,217	5·4	230
Eumirvel Cute Maid	Reflection's Golden Aim (Imp)	J.2	273	3,204	5·8	186
Eumirvel Larkspur	Reflection's Golden Aim (Imp)	J.2	273	3,728	5·3	198
Eumirvel Neradeen	Reflection's Golden Aim (Imp)	J.2	180	2,202	4·1	91
CONOCHIE, W. S., Sherwood (Jersey, 20).						
Brookland Princess Olga	Brookland Merry Monarch	J.2	273	3,910	5·4	213
Brookland Princess Joybelle	Brookland Merry Monarch	S.2	273	4,675	4·8	223
Brookland Fleurette	Brookland Merry Monarch	J.3	273	3,638	6·0	220
Brookland Olga	Brookland Merry Monarch	J.3	273	2,529	5·7	144
Brookland Golden Jubilee	Brookland Regal Sovereign	J.2	273	3,362	5·9	200
Brookland Golden Anna	Brookland Regal Sovereign	J.2	180	2,649	4·5	120
Brookland Noble Buttercup	Brookland Regal Sovereign	J.2	150	1,308	5·4	70
Brookland Regal Prunette	Brookland Regalia	S.2	273	5,612	6·6	369
Brookland Regal Drop	Brookland Regalia	J.3	273	6,176	5·5	341
Brookland Prunette	Brookland Regalia	S.3	273	3,037	5·8	177
Brookland Regal Oakleaf	Brookland Regalia	J.4	273	4,363	5·1	221
Brookland Regal Prunella	Brookland Regalia	S.4	273	4,482	5·6	252
Brookland Regal Fleur	Brookland Regalia	S.4	210	3,459	5·7	198
Brookland Regal Laurel Leaf	Brookland Regalia	M	273	5,236	5·5	286
Brookland Regal Monica	Brookland Regalia	M	273	4,977	5·0	249
Brookland Angel Cake	Bulby Maria's Keepsake	M	273	6,651	5·5	368
Grasmere Lynn's Jubilee	Grasmere Lady Lynn's Jubilee	S.2	273	3,306	5·7	187
Hill Park Fairy Queen	Midlands Fairy Jester	J.3	273	4,388	6·7	294
Brookland Jovial Petunia	Windsor Merry Charles	J.2	273	4,718	6·2	292
Brookland Jovial Lorraine	Windsor Merry Charles	J.2	210	2,163	5·8	125
CORNHILL, E. D. J., Dundas (Jersey, 8).						
Rosedene Lady Olive 2nd	Lawn View Teddy	J.2	273	5,993	4·4	264
Rosedene Beauty's Leaf	Lawn View Teddy	J.2	273	4,116	4·7	194
Rosedene Pretty Lass	Lawn View Teddy	J.2	273	3,759	4·6	193
Rosedene Sally	Lawn View Teddy	S.2	273	5,010	4·4	218
Rosedene Marite	Lawn View Teddy	S.2	273	4,805	4·3	208
Rosedene Jessie	Lawn View Teddy	S.2	273	4,732	4·4	208
Rosedene Lily	Lawn View Teddy	J.3	273	6,084	4·8	294
Rosedene Golden Silver	Lawn View Teddy	J.3	273	4,729	4·6	218
COX, F. J., Kingaroy (Jersey, 10).						
Rosel Gertrude	Belmont Royal Peer	J.2	273	5,141	4·7	244
Rosel Eunice	Belmont Royal Peer	J.2	273	4,323	5·0	215
Rosel Jennifer	Belmont Royal Peer	J.2	273	3,369	5·6	188
Rosel Clare	Belmont Royal Peer	J.2	273	4,150	4·1	169
Rosel Rhonda	Belmont Royal Peer	J.2	273	3,311	4·5	149
Rosel Blanche	Belmont Royal Peer	S.2	210	3,096	4·3	133
Rosel Bonnie	Belmont Royal Peer	J.3	273	4,594	4·9	224
Rosel Blue Spec	Rosel Royal Peer	J.2	210	2,331	4·7	104
Rosel Ginger Girl	Rosel Solid Gold	M	273	6,994	5·7	401
Rosel Elma	Rosel Solid Gold	M	273	5,235	6·2	322

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
COX, R. V. D., Maleny (Jersey, 27).						
Glengarriffe Caesar's Lentil 4th	Glengarriffe Cunning Caesar ..	M	305	8,833	5·2	462
Glengarriffe Caesar's Lentil 4th	Glengarriffe Cunning Caesar ..	M	273	8,099	5·3	426
Glengarriffe Caesar's Gypsy 3rd	Glengarriffe Cunning Caesar ..	M	240	6,405	6·1	392
Glengarriffe Caesar's Fleurette 4th	Glengarriffe Cunning Caesar ..	M	273	6,095	5·9	361
Glengarriffe Caesar's Comfrey 3rd	Glengarriffe Cunning Caesar ..	M	273	6,698	5·2	349
Glengarriffe Caesar's Faith 2nd	Glengarriffe Cunning Caesar ..	M	273	6,135	5·6	342
Glengarriffe Fluster's Rozel 7th	Glengarriffe Cunning Filibuster	J.3	240	5,928	5·4	320
Glengarriffe Fluster's Rozel 7th	Glengarriffe Cunning Filibuster	S.4	273	6,727	5·3	356
Glengarriffe Fluster's Cavell ..	Glengarriffe Cunning Filibuster	S.4	273	5,882	6·0	352
Glengarriffe Fluster's Frailty 3rd	Glengarriffe Cunning Filibuster	S.4	273	5,591	5·8	323
Glengarriffe Fluster's Foxglove 2nd	Glengarriffe Cunning Filibuster	M	273	7,143	6·3	448
Glengarriffe Fluster's Jessie 2nd	Glengarriffe Cunning Filibuster	M	273	6,600	5·6	369
Glengarriffe Fluster's Lubra 2nd	Glengarriffe Cunning Filibuster	M	273	6,217	5·9	367
Glengarriffe Fluster's Frailty ..	Glengarriffe Cunning Filibuster	M	240	3,606	6·6	236
Glengarriffe Foreman's Cavell ..	Glengarriffe Cunning Foreman..	M	273	5,745	5·9	337
Glengarriffe Foreman's Foxglove	Glengarriffe Cunning Foreman..	M	273	6,647	4·9	325
Glengarriffe Collingwood's Cavell	Glengarriffe Dreamer's Collingwood	J.2	273	4,219	6·2	260
Glengarriffe Dreamer's Rosary 2nd	Selsey Dreamer	J.2	273	4,246	5·5	234
Glengarriffe Dreamer's Colleen ..	Selsey Dreamer	J.3	273	5,037	5·4	274
Glengarriffe Dreamer's Coulisse	Selsey Dreamer	S.3	273	6,947	5·7	396
Glengarriffe Dreamer's Coulisse	Selsey Dreamer	S.3	305	7,416	5·7	361
Glengarriffe Dreamer's Hawthorn	Selsey Dreamer	S.3	240	6,282	5·7	357
Glengarriffe Dreamer's Carnation	Selsey Dreamer	S.3	273	5,828	6·0	349
Glengarriffe Dreamer's Freda ..	Selsey Dreamer	J.4	273	6,230	5·7	356
Glengarriffe Dreamer's Gypsy 3rd	Selsey Dreamer	J.4	210	4,215	5·5	232
Glengarriffe Dreamer's Carpel ..	Selsey Dreamer	S.4	273	5,358	5·1	275
Glengarriffe Dreamer's Hawthorn	Selsey Dreamer	M	273	6,827	5·0	344
Glengarriffe Cunning Lentil 2nd	Navua Cunning Lad (Imp.) ..	M	273	6,081	5·3	321
Glengarriffe Cunning Faith ..	Navua Cunning Lad (Imp.) ..	M	273	5,736	5·1	294
CRAMB, S. A., Caboolture (Jersey, 8).						
Fauvic Ballerina	Austral Park Distinction ..	J.2	273	5,355	5·4	291
Fauvic Dazzle	Austral Park Distinction ..	J.2	273	4,476	4·5	199
Fauvic Daydawn	Fauvic Cornet	S.3	273	6,719	4·6	306
Fauvic Daydawn	Fauvic Cornet	S.3	305	7,309	4·6	338
Amaroo Grand Princess	Glengarriffe Caesar's Deemster	J.2	273	5,002	5·4	271
Amaroo Grand Princess	Glengarriffe Caesar's Deemster	J.2	305	5,404	5·5	297
Caergwrle Tulip	Inverlaw Bandmaster	J.3	273	6,141	5·0	308
Caergwrle Tulip	Inverlaw Bandmaster	J.2	305	6,458	5·0	324
Ashdon Silver	Oxford Buttercup's Victory ..	J.2	273	5,688	4·8	272
Glenolive Holly	Trecarne Golden Ruler	S.2	273	5,072	5·5	278
Glenolive Sweet Chimes	Trecarne Golden Ruler	S.3	273	5,574	4·8	268
FARM HOME FOR BOYS, Westbrook (Jersey,14).						
Westbrook Starbright 18th ..	Mornmoot Clementine's Valour	J.2	273	4,538	5·2	238
Westbrook Sultane 14th ..	Mornmoot Clementine's Valour	S.2	273	6,070	4·2	253
Westbrook Tulip 156th	Mornmoot Clementine's Valour	J.3	273	5,661	4·0	228
Westbrook Starbright 16th ..	Westbrook Comet 26th ..	J.3	273	5,734	4·5	259
Westbrook Tulip 155th	Westbrook Comet 26th ..	J.3	273	5,316	4·7	248
Westbrook Bells 20th	Westbrook Comet 26th ..	S.3	273	5,002	5·2	259
Westbrook Sylvia 28th	Westbrook Silvermine's Valour	S.3	273	6,316	4·6	288
Westbrook Pearl 6th	Wyalla Golden Lad	J.2	273	5,663	5·2	294
Westbrook Silvermine 5th ..	Wyalla Golden Lad	J.2	273	5,841	4·7	274
Westbrook Tulip 157th	Wyalla Golden Lad	J.2	273	4,774	5·4	255
Westbrook Tulip 160th	Wyalla Golden Lad	J.2	273	4,403	5·2	230
Westbrook Wyandotte 13th ..	Wyalla Golden Lad	J.2	273	5,016	4·5	224
Westbrook Silvermine 6th ..	Wyalla Golden Lad	J.2	273	5,149	4·1	210
Westbrook Bells 21st	Wyalla Golden Lad	J.3	273	4,695	5·4	254
GRANGER BROS., Lockyer (Jersey, 18).						
Oxford Regal Carolyn	Brookland Regalia	M	273	6,338	5·0	319
Trecarne Ryebread 2nd	Jerseylea Golden Duke	M	273	5,102	5·5	280
Oxford Victoria	Oxford Maid's Victor	M	273	5,716	5·2	297
Trecarne Jersey Queen 13th ..	Regal Design (Imp.)	J.2	273	6,567	5·0	331
Granwyn Seafoam	Trecarne Dairyboy 2nd ..	J.2	273	5,583	4·7	263
Brampton Gifts Goldil	Trecarne Golden Lad 2nd ..	J.2	273	6,475	4·4	288
Trecarne Golden Dairy Girl 5th	Trecarne Golden Lad 2nd ..	J.2	273	4,901	4·9	241
Trecarne Dairy Maid 11th ..	Trecarne Golden Lad 2nd ..	J.3	273	6,647	4·8	321
Trecarne Dairy Queen 5th ..	Trecarne Golden Lad 2nd ..	J.3	273	5,743	5·5	318
Trecarne Ryebread 5th	Trecarne Golden Lad 2nd ..	S.3	273	6,116	5·1	310
Trecarne Golden Jersey Lass ..	Trecarne Golden Lad 2nd ..	J.4	273	7,101	4·7	337
Trecarne Daffodil's Jewel 2nd	Trecarne Ruler 2nd	M	273	4,614	6·1	282
Glenrea Ballad Girl	Trecarne Some Duke	J.2	273	4,396	6·3	279
Glenrea Some Attraction ..	Trecarne Some Duke	S.3	273	5,804	5·8	339
Trecarne Jersey Queen 8th ..	Trecarne Some Duke	M	273	6,506	5·6	368
Trecarne Dairy Queen 3rd ..	Trecarne Some Duke	M	273	7,431	4·6	340
Trecarne Jersey Lass 6th ..	Trecarne Some Duke	M	273	7,317	4·4	322
Trecarne Doreen 7th	Trecarne Some Duke	M	273	6,294	4·7	295

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
GRASMERE JERSEY STUD, Neurum, *via* Kilcoy (Jersey, 9).						
Grasmere Doves Lily	Grasmere Elaine's Victory	J.3	240	2,532	7·1	180
Grasmere Lynn's Sultane	Grasmere Lady Lynn's Victory	S.3	210	3,387	5·1	171
Grasmere Lynn's Colleen	Grasmere Lady Lynn's Victory	S.3	90	1,230	7·0	87
Ashden Bright Face	Oxford Buttercup Victory	S.3	240	3,078	5·3	162
Grasmere Victory Charm	Oxford Brown Victory	M	240	5,262	5·3	281
Glenside Jovial Lass	Oxford Dudley	J.4	150	1,440	5·9	86
Trecarne Daffodil 3rd	Trecarne Ruler 2nd	M	240	4,404	4·5	199
Trinity Crowning Princess 2nd	Trinity Crowning Effort	M	273	3,326	5·7	190
Glenview Gaythorne	Trinity Royal Prince	M	150	1,908	6·1	117
GREGORY, P. H. F., Rosevale, *via* Rosewood (Jersey, 2).						
Windsor Royal Patricia	Brookland Lord Roseberry	J.2	273	5,114	5·5	287
Windsor Royal Rose	Brookland Merry Monarch	J.3	273	5,698	5·5	316
HARLEY, G., Kingaroy (Jersey, 9).						
Romsey Dainty Spot	Oxford Pixie's Victor	M	273	6,483	5·2	335
Hopewell Poppy	Trinity Cute Premier	J.2	273	4,475	5·5	245
Hopewell Desley 2nd	Trinity Daffodil's Design	J.4	273	5,315	4·5	241
Hopewell Sunflower	Trinity Daffodil's Design	M	273	5,843	5·1	296
Hopewell National Lass	Trinity National Duke 2nd	J.2	273	4,735	5·5	261
Hopewell National Larkspur	Trinity National Duke 2nd	J.2	273	4,577	5·5	252
Hopewell National Victorious	Trinity National Duke 2nd	J.2	273	4,134	5·8	240
Hopewell National Maid	Trinity National Duke 2nd	J.2	90	783	4·7	37
Hopewell National Lily	Trinity National Duke 2nd	S.2	273	6,789	5·2	352
HUEY, C., Sabine, *via* Oakey (Jersey, 6).						
Ashview Lady 5th	Ashview Double Duke	S.2	273	4,842	5·4	260
Ashview Joyful	Parrabel Oxford Thorn	J.2	273	4,092	5·3	217
Ashview Bracken	Parrabel Oxford Thorn	J.2	273	4,120	4·9	204
Ashview Ladyette 3rd	Trecarne Some Tot's Duke 2nd	J.2	273	3,751	6·1	229
Ashview Tot 2nd	Trecarne Some Tot's Duke 2nd	J.2	273	3,671	5·4	197
Ashview Mossrose	Trecarne Some Tot's Duke 2nd	S.2	273	2,963	5·1	152
JOHNSON, H. G., Beaudesert (Jersey, 5).						
Windsor Regal Countess	Brookland Lord Roseberry	J.2	273	6,096	5·3	325
Windsor Regal Melba	Brookland Lord Roseberry	J.2	273	5,692	5·1	291
Windsor Royal Ann	Brookland Lord Roseberry	S.2	273	5,476	5·4	297
Windsor Royal Ruth	Brookland Merry Monarch	S.4	273	8,393	5·4	452
Windsor Princess Florence	Bobs of Wingate	M	273	6,882	5·2	356
KIRBY, W. S., Tinana (Jersey, 9).						
Broadview Royal Budget	Trinity Beauty's Hero	J.4	273	4,294	5·7	246
Broadview Red Fern	Trinity Irondele's Effort	J.2	273	4,562	5·5	253
Broadview Crowning Brunette	Trinity Irondele's Effort	J.2	273	4,355	4·1	180
Broadview Mary Ann	Trinity Irondele's Effort	J.2	273	3,635	4·5	163
Broadview Effort's Beauty 2nd	Trinity Irondele's Effort	S.2	273	4,629	4·8	221
Broadview Betsy 2nd	Trinity Irondele's Effort	J.3	273	4,377	5·7	250
Broadview Effort's Dream	Trinity Irondele's Effort	J.3	273	4,103	5·2	215
Broadview Beth	Trinity Irondele's Effort	S.3	273	4,361	5·6	245
Broadview Lu Lu	Trinity Irondele's Effort	S.3	273	4,285	4·9	210
KERLIN, P., KILLARNEY (Jersey, 19).						
Glenrandle Verabelle	Bellgarth Stylish	M	273	8,798	5·7	499
Glenrandle Golden Girl	Bellgarth Stylish	M	273	6,062	5·6	341
Glenrandle Fashion Lady	Bellgarth Stylish	M	273	5,066	5·7	290
Glenrandle Stylish Lil	Bellgarth Stylish 2nd	J.2	273	5,598	4·8	269
Glenrandle Viola	Bellgarth Victory 6th	S.2	273	5,336	6·2	329
Glenrandle Evenbelle 2nd	Gem Rodney	S.3	273	4,411	5·8	256
Glenrandle Joan	Gem Rodney	J.4	273	6,122	6·1	374
Glenrandle Joan	Gem Rodney	J.4	305	6,599	6·1	403
Glenrandle Fair Lassie 2nd	Gem Rodney	J.4	273	4,845	6·7	318
Glenrandle Lucilla	Gem Rodney	J.4	180	4,242	5·5	235
Golden View Lady Lass	Trecarne Playboy	J.2	273	6,802	4·3	289
Trecarne Bright Dairymaid	Trecarne Golden Lad 2nd	J.2	60	720	7·9	57
Glenrandle Gleam Girl	Trinity Gleaming Effort	J.2	273	6,551	5·7	375
Glenrandle Daisy Bell 2nd	Trintiy Gleaming Effort	J.2	273	5,892	5·6	328
Glenrandle Milk Maid 2nd	Trinity Gleaming Effort	J.2	273	5,149	5·2	270
Glenrandle Gleam Girl	Trinity Gleaming Effort	S.2	273	7,280	5·9	426
Glenrandle Gleaming Maid	Trinity Gleaming Effort	S.2	273	6,630	5·4	361
Glenrandle Goldenette 2nd	Trinity Gleaming Effort	J.3	273	6,739	5·7	382
Glenrandle Charm 2nd	Trinity Gleaming Effort	J.3	240	4,995	6·6	332
Glenrandle Spotted Lady	Oxford Noble Peer	M	210	4,200	5·5	229
LEITCH, E. M., Kenmore (Jersey, 1).						
Gem May's Maggie	Gem May's Keepsake	J.2	273	5,298	5·3	279

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Re-corded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
LOUTTIT, D. J., Mulgeldie (Jersey, 6).						
Lindvale Choice	Glenview Lochiel	J.3	120	2,130	5·0	107
Upwell Fay Fawn	Glenview Some Sultan	J.4	273	6,966	5·1	356
Upwell Gay Guest	Glenview Some Sultan	M	273	6,925	5·2	361
Boree Effort's Perfect	Trinity Daffodil's Effort	J.2	273	6,800	5·0	334
Boree Effort's Perfect	Trinity Daffodil's Effort	J.2	305	7,396	4·9	364
Boree Effort's Roslyn	Trinity Daffodil's Effort	J.2	273	6,740	4·4	295
LOVELL, J. F. and H. A., Samford (Jersey, 5).						
Glenbrook Lady Lynn	Glenbrook Governor	M	273	6,931	4·7	329
Golden View Xmas Lily	Kardenia Beauty's Volunteer	M	273	5,927	5·8	345
Glenbrook Rose Nella 2nd	Lermont Golden Victory	M	273	6,060	5·3	322
Glenbrook Sunshine 2nd	Lermont Golden Victory	M	273	5,284	5·7	302
Tarana Lady Nelleen	Oxford Bruno	J.2	273	4,231	5·5	233
Tarana Lady Au-Lynne	Oxford Bruno	J.4	273	5,158	6·2	320
McCARTHY, J. S., Greenmount (Jersey, 14).						
Glen Erin Lady Hopeful	Ashfield Prometheus	J.2	273	7,030	5·0	354
Glen Erin Lady Hopeful	Ashfield Prometheus	J.2	305	7,537	5·1	382
Glen Erin Silver Spray	Ashfield Prometheus	J.2	273	6,001	5·6	335
Glen Erin Tulip 2nd	Ashfield Prometheus	J.2	273	7,014	4·6	326
Glen Erin Princess 2nd	Ashfield Prometheus	S.3	273	9,110	4·9	446
Kathleigh Bonnie Pride	Ellerdale Ruler's Sultan	J.2	273	6,538	5·3	347
Ellerdale Watfern Berenice	Ellerdale Watfern Gamboge	S.3	240	6,657	6·1	403
Ellerdale Watfern Berenice	Ellerdale Watfern Gamboge	S.4	273	7,629	5·1	387
Trinity Crowning Rose	Trinity Crowning Effort	J.3	180	4,335	4·9	214
Glen Erin Bright Girl	Trinity Cute Monarch	J.2	273	6,188	5·2	321
Glen Erin Bright Girl	Trinity Cute Monarch	J.2	305	6,620	5·3	351
Glen Erin Model 2nd	Trinity Cute Monarch	J.2	180	4,557	5·0	228
Glen Erin Daffodil 2nd	Trinity Margaret's Effort	J.2	273	6,887	4·9	334
Glen Erin Effort's Viola	Trinity Margaret's Effort	J.2	273	5,225	4·7	243
Glen Erin Kathleen	Westbrook Valour 29th	J.2	273	5,473	5·3	292
Glen Erin Velvet	Westbrook Valour 29th	S.2	273	5,575	5·3	297
MARSDEN, L., Canaga, *via* Chinchilla (Jersey, 9).						
Fernflat Fairy	Ashview Eva's Victor 3rd	J.2	273	3,104	6·7	208
Woodview Birdie	Ashview Peer	S.4	273	4,398	5·1	223
Woodview Heatherbell 2nd	Brookland Royal Regalia	J.2	273	5,432	5·1	276
Woodview Lovebird	Brookland Royal Regalia	J.2	240	4,401	5·0	221
Trecarne Bright Tottie 2nd	Regal Design (Imp.)	J.2	240	3,330	5·3	178
Trecarne Aileenette 7th	Trecarne Golden Lad	J.2	273	3,897	5·5	215
Trecarne Golden Jewel	Trecarne Golden Lad 2nd	J.3	273	4,085	4·9	202
Ashview Rosemond 2nd	Trecarne Some Tot's Duke 2nd	S.3	273	5,594	6·1	343
Fernflat Royal Lady	Woodview Basher	J.2	273	4,021	5·5	221
MATTHEWS, E. A., Yarraman (Jersey, 7).						
Oakvale Lady	Glenview Exchange	M	273	7,447	4·9	365
Yarradale Rejoice	Grasmere William	J.2	273	3,907	5·4	209
Yarradale Felicity	Grasmere William	J.2	273	2,976	6·1	183
Yarradale Rosebud 2nd	Grasmere William	J.2	210	1,665	6·0	100
Sunnyside Elsa 3rd	Sunnyside Banjo	M	273	5,927	5·4	321
Yarradale Rosina	Smythesdale Bruce	S.3	210	3,393	4·9	167
Yarradale Gold Dust	Smythesdale Bruce	S.3	210	3,459	4·3	150
MAY, M. Miss, Hermitage, *via* Warwick (Jersey, 3).						
Englebourne Remus' Gem	Englebourne Gem's Remus	J.3	273	5,623	5·3	300
Englebourne Daffodil	Englebourne Gem's Remus	J.2	273	4,873	5·9	287
Englebourne Trixie	Grasmere Daisy's Victory	J.3	150	3,315	5·4	179
NEWTON, E. C., Caboolture (Jersey, 6).						
Malvern Royal Relma	Grasmere Gambogia's Royal	J.2	273	4,705	5·5	260
Malvern Royal Calm	Grasmere Gambogia's Royal	S.2	273	5,139	4·5	233
Malvern Freda	Grasmere Gambogia's Royal	J.3	273	3,859	5·5	212
Merrivale Cunning Peeress	Tecoma Cunning Lad	J.2	273	3,486	5·1	177
Boree Tulip's Maid	Trinity Daffodil's Effort	S.2	273	4,945	4·3	213
Boree Peeress Pride	Trinity Daffodil's Effort	J.3	273	4,308	3·9	170
NOCK, T., Degilbo (Jersey, 8).						
Broad View Coral 2nd	Trinity Beauty's Hero	M	273	6,970	5·1	355
Trinity Woodbine 2nd	Trinity Crowning Effort	J.2	273	4,157	5·2	215
Trinity Darling Brunette	Trinity Crowning Effort	S.4	273	7,288	4·9	364
Trinity Sweet Hazel	Trinity Crowning Effort	S.4	273	6,962	4·8	334
Boree Effort's Mischief	Trinity Daffodil's Effort	S.4	273	8,540	4·2	362
Boree Effort's Cornflower	Trinity Daffodil's Effort	M	273	7,523	4·7	356
Ellescar Graceful Darling	Trinity Graceful Lad	J.3	273	5,629	5·0	280
Trinity Cute Royalty 2nd	Trinity Prince Royal	S.2	273	4,343	5·4	236

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butter-fat.
				Lb.	%	Lb.
PORTER, F., Conondale, *via* Maleny (Jersey, 21).						
Westwood Coronation	Belgonia Flashlight	J.2	273	4,960	5·8	290
Westwood Favorite	Belgonia Flashlight	J.2	273	4,278	6·1	260
Westwood Snowstar	Belgonia Flashlight	S.2	273	5,171	5·0	256
Westwood Fairy Floss	Devon Park Madiera's Victorious	J.2	273	4,413	6·6	291
Westwood Hawthorn	Devon Park Madiera's Victorious	J.2	273	4,983	5·5	276
Westwood Clover Leaf	Devon Park Madiera's Victorious	J.2	273	4,845	5·5	267
Westwood Gold Time	Devon Park Madiera's Victorious	J.2	273	4,406	5·2	231
Westwood Lorena	Devon Park Madiera's Victorious	J.2	273	2,794	5·6	157
Westwood Emerald Isle	Devon Park Madiera's Victorious	J.2	273	2,672	5·4	145
Westwood Golden Lotus	Devon Park Madiera's Victorious	S.2	273	5,266	5·2	275
Westwood Mirabel	Devon Park Madiera's Victorious	S.3	273	6,216	5·8	363
Westwood Goldenia	Devon Park Madiera's Victorious	M	273	7,599	5·1	418
Ferncrest Pilot's May	Glenview Sky Pilot	S.2	150	1,467	4·6	60
Westwood Gayness	Westwood Silver Standard	J.2	210	2,448	6·2	151
Westwood Sunglaze	Westwood Silver Standard	J.3	273	6,653	5·9	390
Westwood Carmel	Westwood Silver Standard	J.2	273	4,816	5·8	281
Westwood Dahlia	Westwood Snowman	J.2	210	2,238	4·7	105
Westwood Regal Court	Westwood Vice Regal	J.2	273	3,513	5·6	195
Westwood Heloise	Westwood Vice Regal	J.2	273	3,045	5·8	177
Westwood Regal Gem	Westwood Vice Regal	J.2	273	2,690	5·8	151
Westwood Florist	Westwood Vice Regal	J.2	273	3,067	4·9	150
Q.A.H.S. and COLLEGE, Lawes (Jersey, 8).						
College Victory's Floss	Grasmere Twinkles Victory	J.2	273	5,403	5·3	288
College Victory's Mistletoe	Grasmere Twinkles Victory	J.2	273	5,716	4·9	258
College Victory's Holly	Grasmere Twinkles Victory	S.2	273	5,314	5·2	274
Glenside Rhonda	Oxford Dudley	S.4	273	8,732	4·7	412
Glenside Ivy 2nd	Oxford Dudley	S.4	273	6,658	5·5	363
College Victor's Ivy	Oxford Fawn's Victor	J.2	273	5,402	5·8	315
College Victor's Tulip	Oxford Fawn's Victor	J.2	180	2,031	4·4	90
College Victor's Florette	Oxford Fawn's Victor	S.2	273	6,643	4·9	325
RALPH, G. H., Ravensbourne (Jersey, 2).						
Ashview Fairy	Ashview Eva's Victor	S.2	90	1,386	5·5	76
Ashview Fretful	Parrabel Oxford Thorn	J.2	240	2,355	6·1	143
SEMGREEN, A. L., Coolabunia, *via* Kingaroy (Jersey, 10).						
Tecoma Blue Fern	Austral Park Double Blue	J.2	273	5,227	5·4	285
Tecoma Blue Jay	Austral Park Double Blue	J.2	273	3,101	5·9	182
Tecoma Myrtle	Austral Park Double Blue	S.4	150	3,240	5·5	178
Tecoma Blue Columbine	Austral Park Double Blue	M	273	6,361	5·1	326
Austral Park New Princess	Austral Park Nice Lad	M	273	6,675	4·2	280
Tecoma Prissie	Glenview Royal Chief	M	273	4,502	6·8	307
Tecoma Flora	Glenview Royal Chief	M	210	3,402	5·0	170
Tecoma Florian Lass	Tecoma Florian	J.2	273	3,095	5·2	162
Tecoma Ginger Pet	Trinity Golden Royal	J.2	273	4,017	5·5	220
Tecoma Golden Locket	Trinity Golden Royal	M	273	5,112	4·9	253
SIGLEY, H., Jaggan, *via* Malanda (Jersey, 14).						
Riviera Hopeful Duchess	Astor Crowning Star	J.2	273	3,994	5·2	207
Inverlaw Melva	Inverlaw Councillor	M	273	6,143	4·8	297
Myrtledale Fairy Queen	Inverlaw Royal Banner	J.2	273	4,489	6·2	279
Myrtledale Sally	Inverlaw Royal Banner	J.2	273	3,219	6·1	195
Myrtledale Seaweed	Inverlaw Royal Banner	J.2	273	4,308	5·3	221
Myrtledale Posey	Inverlaw Royal Banner	J.2	240	3,204	4·9	158
Myrtledale Icicle	Myrtledale Dandy	S.3	273	5,621	5·1	285
Riviera Miss Melody	Navua Designing Star	M	273	5,792	5·2	300
Myrtledale Dora	Oxford Remus Count	M	273	4,814	6·6	318
Palm Ridges Bounce	Palm Ridges Combination	J.2	273	3,726	6·3	234
Myrtledale Helen	Palm Ridges Golden Victory	J.2	273	4,059	5·1	207
Myrtledale Dream	Palm Ridges Golden Victory	J.4	273	4,017	6·8	274
Myrtledale Model	Palm Ridges Golden Victory	M	273	7,115	5·4	385
Trinity Crowning Beauty	Trinity Crowning Effort	M	273	6,678	5·1	339
SPRESSER, W. and SONS, Rosewood (Jersey, 7).						
Carnation Hazel	Carnation Toy	S.2	273	4,117	5·3	218
Carnation Kit	Carnation Toy	J.2	60	489	4·9	24
Carnation Frances	Inverlaw Syrian Victor	J.2	273	3,638	4·8	174
Carnation Barbara	Oxford Fawn's Victor	S.4	273	4,938	5·1	253
Carnation Joy	Rosslyn Royal Trigger	M	273	4,703	5·1	236
Carnation Hope's Hazel	Trecarne Victor 2nd	M	273	4,918	5·0	246
Carnation Blue Daisy	Trinity General Effort	J.2	273	3,476	5·2	181

Pure-bred Dairy Cattle Production Recording.

Cow.	Sire.	Age.	Days Recorded.	Production.		
				Milk.	Test.	Butterfat.
				Lb.	%	Lb.
THEUERKAUF, H., Dundas (Jersey, 5).						
Lawn View Queenie	Carnation Brown Lad	J.2	273	5,450	4·5	243
Lawn View Princess	Carnation Brown Lad	J.2	273	4,574	4·8	221
Lawn View Dell	Carnation Brown Lad	J.2	273	4,039	5·1	207
Lawn View Fay	Carnation Brown Lad	S.2	273	5,373	5·1	273
Oxford Val	Oxford Royal Ace	J.2	273	5,282	4·3	225
WACKERLING, M. R., Ravensbourne (Jersey, 6).						
Minidong Doreen	Balwyn Ettrey	J.2	273	3,110	5·8	181
Minidong Beauty	Balwyn Love's Peer 3rd	J.3	273	4,155	6·4	267
Minidong Dorothy	Minidong Golden Noble	S.2	273	3,797	6·2	236
Minidong Golden Lily	Minidong Noble Lad	J.2	273	4,294	5·7	243
Janefield's Clementine 9th	Westbrook Valour	J.2	273	3,810	5·8	222
Janefields Loxetta 8th	Westbrook Valour	S.2	240	3,066	5·1	157
WADLEY, D., Indooroopilly (Jersey, 8).						
Nindethana Lindy Lou	Oxford Remus Victory	J.2	273	5,450	5·6	308
Nindethana Priscilla	Oxford Remus Victory	J.2	273	4,676	5·7	267
Nindethana Victory Ida	Oxford Remus Victory	J.2	273	5,135	4·8	247
Nindethana Victorious Lady	Oxford Remus Victory	J.2	273	4,253	5·5	236
Trinity Crowning Gift	Trinity Crowning Victory	J.2	273	4,680	6·1	289
Trinity Prim Lass	Trinity Crowning Effort	M	273	6,269	4·5	284
Trinity Cute Lady 2nd	Trinity Cute Effort	M	273	6,913	5·0	349
Rangelands Effort's Lady	Trinity Lady's Effort	J.2	273	5,258	5·3	278
WAITE, H. M., Palmwoods (Jersey, 17).						
Brooklodge Queenie 5th	Connemara Craftsman	J.2	240	3,516	5·0	178
Brooklodge Sweet Nell	Oxford Baritone	M	273	4,726	4·6	222
Brooklodge Sepia	Oxford Jolly Peer	M	273	5,363	5·3	282
Brooklodge Cherry Ripe 2nd	Trecarne Some Victor 4th	J.2	273	6,010	4·4	263
Brooklodge Jessica 3rd	Trecarne Some Victor 4th	J.2	273	4,083	5·4	222
Brooklodge Melodious 2nd	Trecarne Some Victor 4th	J.3	273	4,799	6·0	288
Brooklodge Brilliant	Trecarne Some Victor 4th	M	240	5,562	5·8	326
Brooklodge Dione	Trecarne Some Victor 4th	M	273	5,337	5·6	298
Brooklodge Cleone	Trecarne Some Victor 4th	M	273	4,941	5·1	251
Brooklodge Maiden 3rd	Trinity Mighty Prince	J.2	273	4,994	5·0	251
Brooklodge Olga 2nd	Trinity Mighty Prince	J.2	273	4,346	5·8	250
Brooklodge Choice Lady 2nd	Trinity Mighty Prince	J.2	273	4,267	5·5	235
Brooklodge Raylee 2nd	Trinity Mighty Prince	J.2	273	4,106	5·4	220
Brooklodge Sepia 2nd	Trinity Mighty Prince	J.2	273	4,314	5·0	215
Brooklodge Muriel 2nd	Trinity Mighty Prince	S.2	240	4,311	5·0	214
Brooklodge Golden Leaf	Trinity Mighty Prince	M	273	5,049	5·2	261
Brooklodge Fay's Butterfy	Trinity Mighty Prince	M	273	4,824	5·2	250
WHITE, W. A. and D., Malanda (Jersey, 6).						
Coraldale Rosebud	Coraldale Noble Hero	J.2	273	3,490	5·5	190
Coraldale Duchess	Peeramon Aviator	J.2	273	4,001	5·2	207
Coraldale Ivy	Peeramon Aviator	J.3	273	3,965	5·7	227
Coraldale Pearl	Peeramon Britain	J.2	273	3,939	5·5	216
Coraldale Sunbeam	Peeramon Britain	J.2	273	3,703	5·7	211
Peeramon Buttercup	Trinity Popcorn 2nd's Pioneer	M	240	4,509	5·3	240
WILTON, J., Killarney (Jersey, 3).						
Romsey Syria	Oxford Flying Fox	J.2	273	4,061	5·8	235
Romsey Lady Fox	Oxford Flying Fox	J.3	273	6,616	6·1	401
Romsey Brown Lady	Oxford Flying Fox	S.3	273	4,899	6·0	293

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 31st JANUARY, 1953.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Sunny Crest " Stud, Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman W. H. Thompson, " Alfa Vale," Nanango
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain " St. Christopher's and Iona " Studs, Brookfield road, Brisbane E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket. Esk W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango F. W. Verrall, " Coleburn," Walloon
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 31st JANUARY, 1953.)

Breed.	Owner's Name and Addres of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, via Pittsworth
	F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Sto dville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Hillcrest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
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	J. A. Heading, " Highfields," Murgon
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	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

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	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, Box 22, Maleny
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochdale
	H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
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ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.57	5.47	Cairns	20	38	Longreach	31	39
6	6.00	5.41	Charleville ..	26	28	Quilpie	36	34
11	6.02	5.36	Cloncurry	44	56	Rockhampton ..	6	14
16	6.05	5.30	Cunnamulla ..	29	29	Roma	16	18
21	6.08	5.26	Dirranbandi ..	20	18	Townsville ..	18	33
26	6.10	5.21	Emerald	15	23	Winton	35	45
30	6.12	5.18	Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	6.26	7.12
2	7.02	8.08
3	7.44	9.06
4	8.32	10.05
5	9.26	11.04
		p.m.
6	10.26	12.01
7	11.31	12.52
8	..	1.38
	a.m.	
9	12.37	2.21
10	1.44	2.59
11	2.50	3.36
12	3.57	4.13
13	5.03	4.50
14	6.11	5.30
15	7.20	6.15
16	8.28	7.03
17	9.33	7.57
18	10.34	8.54
19	11.27	9.53
	p.m.	
20	12.14	10.51
21	12.54	11.48
22	1.29	..
		a.m.
23	2.00	12.43
24	2.29	1.35
25	2.57	2.27
26	3.25	3.19
27	3.55	4.11
28	4.27	5.05
29	5.02	6.01
30	5.42	6.59

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	25	14	42	29	17	4	49	33
6	30	9	45	24	20	0	53	26
11	22	18	38	34	13	9	43	38
16	11	29	26	44	0	20	29	52
21	12	26	27	42	2	18	30	50
26	21	19	37	34	12	10	43	39
30	28	12	44	26	19	1	52	29

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	44	15	61	41	45	26	37	14
3	52	7	66	35	50	21	43	8
5	55	3	68	32	51	18	45	4
7	51	5	65	35	49	20	42	6
9	46	14	62	40	47	25	38	14
11	35	26	54	47	39	33	29	22
13	23	38	46	56	30	41	20	33
15	12	48	38	62	23	48	11	40
17	5	55	35	67	19	52	5	45
19	5	52	35	65	19	50	5	44
21	11	46	38	61	23	47	10	38
23	20	41	43	58	28	44	17	35
25	28	32	50	53	34	38	24	28
27	38	23	56	45	41	30	32	20
29	47	12	63	38	47	24	39	12
30	51	8	65	36	49	21	42	8

Phases of the Moon.—Last Quarter, April 7, 2.58 p.m.; New Moon, April 14, 6.09 a.m.; First Quarter, April 21, 10.40 a.m.; Full Moon, April 29, 2.20 p.m.

On April 15 the sun will rise and set approximately 12 degrees north of true east and true west respectively, and on the 12th and 25th the moon will rise and set very close to true east and true west respectively.

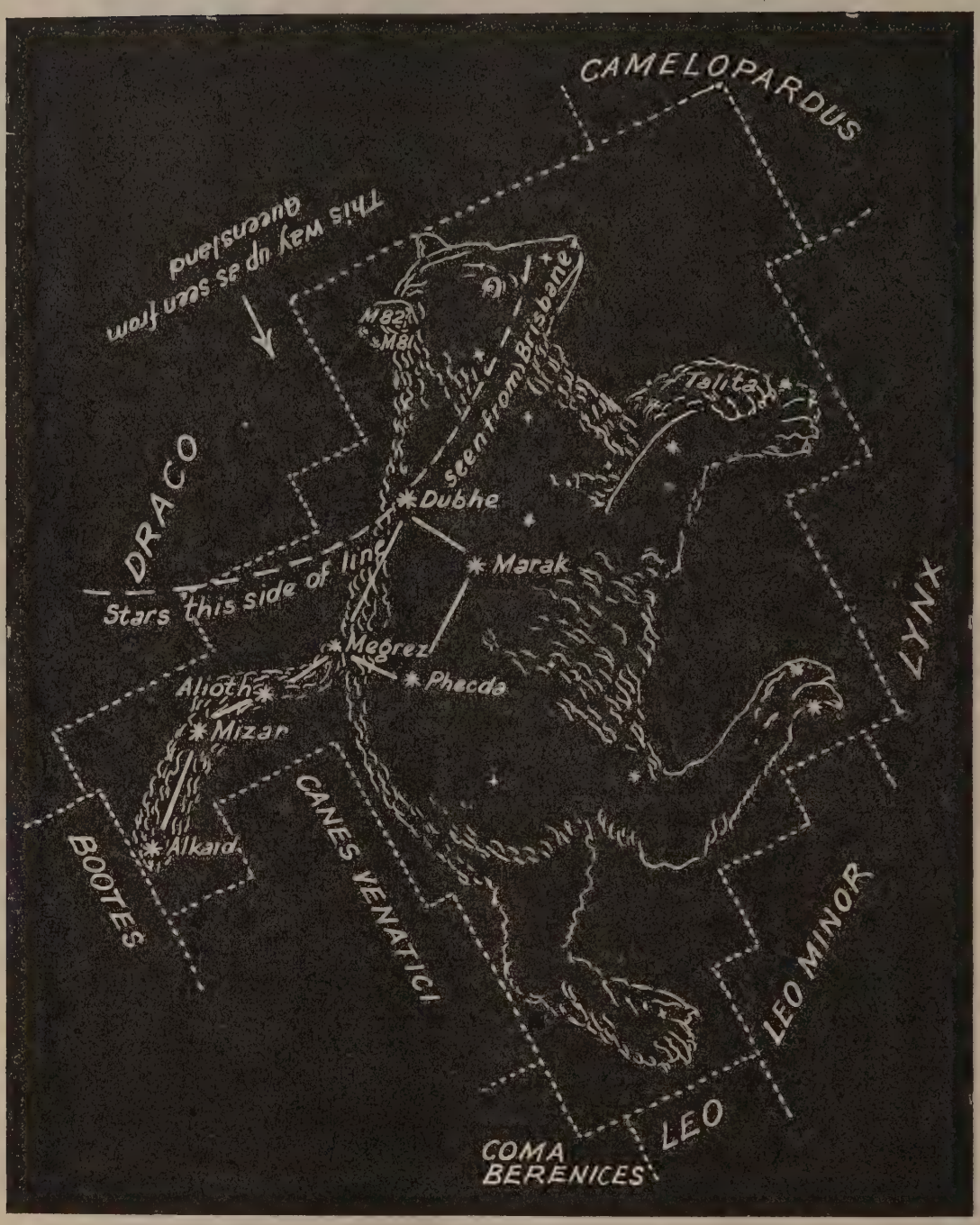
Mercury.—Remains in the constellation of Pisces all the month. On the 1st will rise 1½ hours before the sun and will reach greatest angle west of the sun on the 15th, when it will rise 2 hours before sunrise. About the 28th it will pass Venus, and at the end of the month it will rise 1 hour 44 minutes before the sun. The moon will be near on the 12th.

Venus.—Will be an evening object at the beginning of the month, setting ½ hour after sunset. On the 13th it will be in line with the sun, after which it will pass into the morning sky, and by the end of the month, in the constellation of Pisces, will rise 1 hour 47 minutes before sunrise.

Mars.—In the constellation of Aries and Taurus, is now too close in line with the sun for observation.

Jupiter.—May be seen with difficulty at the beginning of the month in the constellation of Aries, when it will set 2 hours 6 minutes after the sun. At the end of the month, in the constellation of Taurus and close to Mars, it will set only 1 hour after sunset. On the 16th the moon will be near Jupiter and Mars.

Saturn.—At the beginning of April will rise soon after sunset, but by the end of the month it will be well up in the eastern sky at nightfall. It is placed in the constellation of Virgo.



THE CONSTELLATIONS.

URSA MAJOR (THE GREAT BEAR).

This group is well known to inhabitants of the northern hemisphere, almost everyone there being able to recognise this constellation. Besides the Larger or Great Bear, it is also known by "The Big Dipper," "The Plough," "Butcher's Cleaver" and "Charles' Wain" (wagon). North of latitude 40 degrees north it always remains above the horizon and Dubhe (Alpha) and Merak (Beta) often referred to as "The Pointers," are excellent guides to identifying Polaris or The North Pole Star, which is contained in the constellation of Ursa Minor. Because of the large area covered, it can be seen quite plainly low on the northern horizon from as far south as Brisbane, the most advantageous time to observe it being about 10 p.m. at the beginning of May and about 8 p.m. at the beginning of June. None of the stars of this group are larger than second magnitude. The star at the end of the handle of the Dipper is called Alkaid (Eta), or sometimes Benetnasch. The next star to Alkaid is Mizar (Zeta), and close to Mizar is a 4th magnitude star called Alcor. Mizar is interesting historically as it was the first star discovered and mentioned as a double star. It was also the first double to be satisfactorily photographed. Its brighter component was the first star discovered with a spectroscope to be a double. The third star in the handle is Alioth (Epsilon). Where the handle joins the bowl is Megrez (Delta) and below it is Phecda (Gamma). Of the Pointers, Dubhe is closer to the Pole. Ursa Major includes besides the bright stars of the Dipper many others of lesser brilliance. It contains many doubles and nebulae, including the well-known spiral galaxy M81 and the almost edge-on spiral M82. The dotted line on the diagram shows the horizon as seen from Brisbane at most favourable observation.

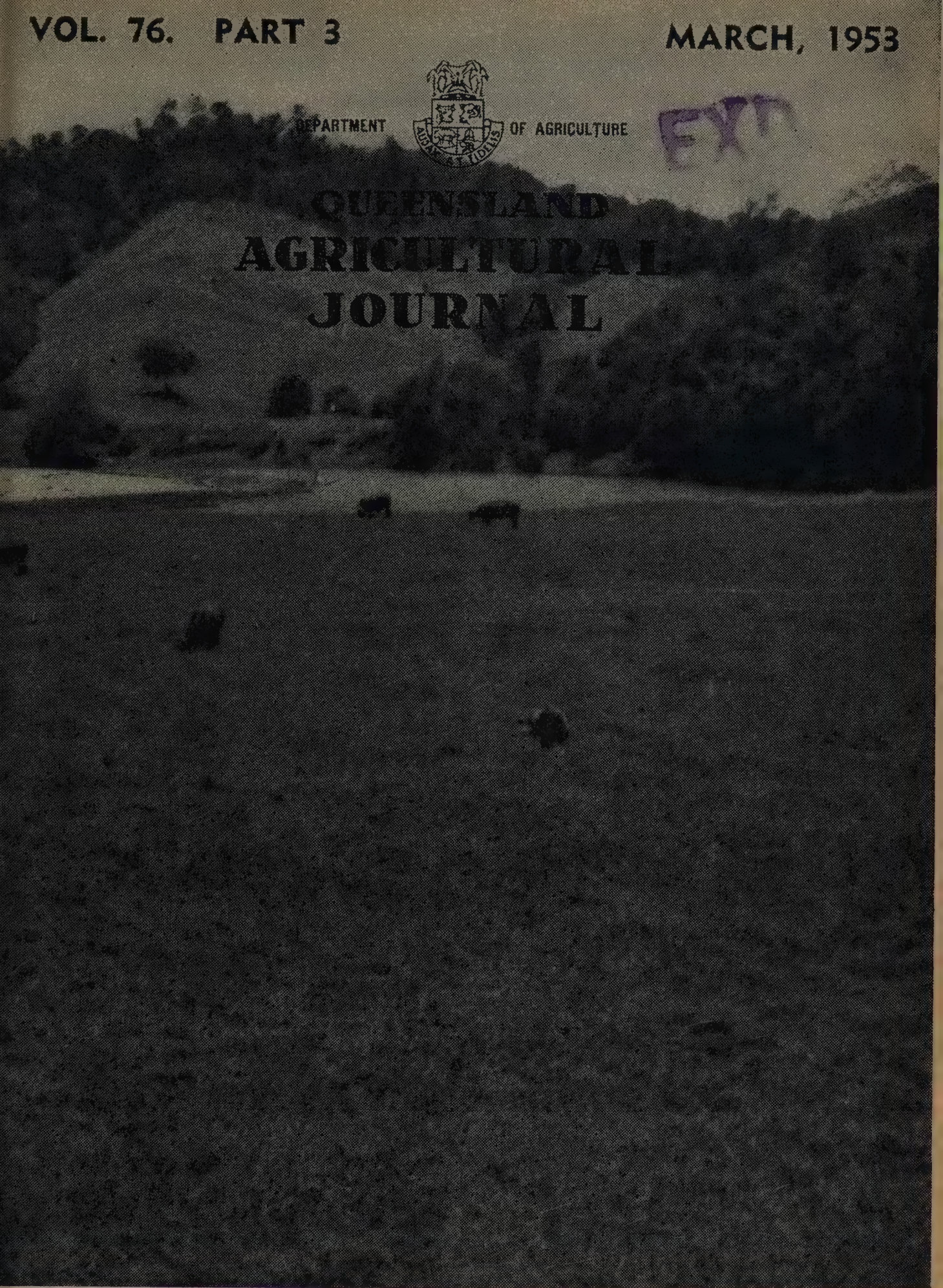
LYNX.

This is an inconspicuous group situated between Auriga and Ursa Major and north of Cancer and Gemini.

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QUEENSLAND AGRICULTURAL JOURNAL



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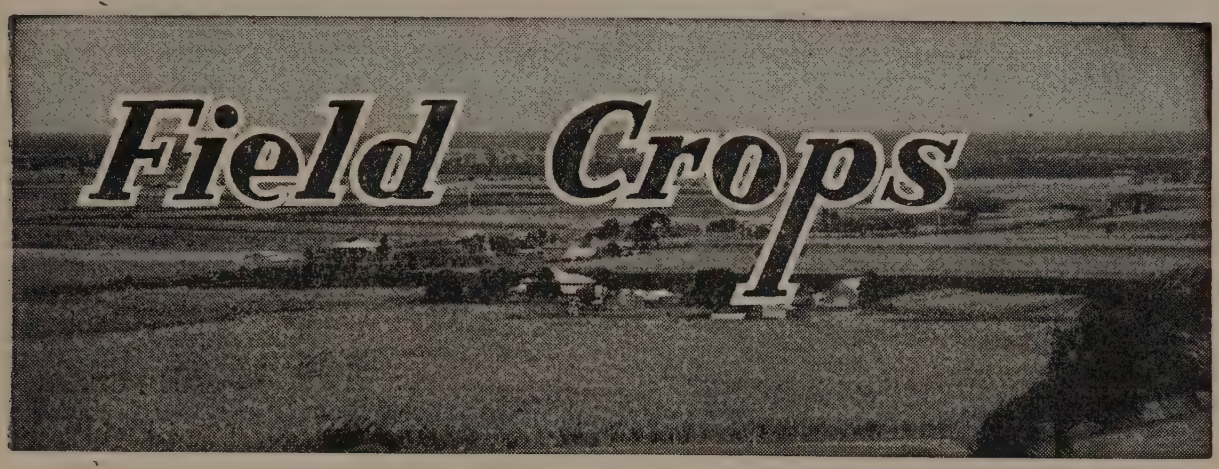
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Upland Rice Growing in Queensland.

T. G. GRAHAM (Agrostologist) and J. W. LITTLER (Assistant Agronomist), Agriculture Branch.

RICE is probably the most important of the cereals—it is the grain staple in the diet of more than half the people of the world. Owing to the diversity of types and strains found in the various countries, it is not certain whether the original home of rice was in South-eastern Asia, India, China or Indo-China.

The wide range of varieties makes it possible to produce good crops under various soil and climatic conditions, ranging from stiff clays to sandy loams, from swamps to well-drained soils and from moist tropical heat at sea level to elevations of 7,000 feet within the tropics. Although it is a tropical cereal found growing luxuriantly in its native environment of high temperatures and high atmospheric humidity, rice has been found to grow with great success under irrigation in some temperate regions such as the Murrumbidgee Irrigation Area of Australia and the southern States of the United States of America.

The world's cultivated varieties of rice fall into two main groups, the swamp or lowland types and the upland types. Swamp rice, as the name suggests, thrives best with a very high level of soil moisture. It is customary to maintain water to a depth of several inches over fields of swamp rice from the early growth stage until the crop commences to mature. Upland rice is synonymous with hill paddy, dryland rice, and mountain rice, and for many years has been cultivated outside the flooded delta regions and terraced irrigated areas for which the Far East is famous. Normally it is not irrigated.

From a nutritional point of view, upland rice is reported to be superior to swamp rice. Analyses of samples carried out in different countries reveal that while average upland rice contains 11.27 per cent. protein and 1.8 per cent. total nitrogen, average swamp rice contains 9.84 per cent. protein and 1.5 per cent. total nitrogen. Upland rice is claimed to be richer in protein compounds and starchy matter, but not in minerals, though some varieties have outstanding individual qualities.

HISTORY OF RICE GROWING IN QUEENSLAND.

Rice growing in Queensland dates back to the second half of the last century. Mr. A. J. Boyd introduced the crop to areas along the Logan, Albert and Pimpama Rivers, by planting a Japanese variety on "Ormeau" Sugar Plantation in 1869. Eventually a small rice mill was established in this area.

In North Queensland in the early days, the Chinese grew rice along the river banks, especially in the Innisfail-Cairns area, and a rice mill is known to have been in operation at Cairns about 1909. Later, in 1917, rice was grown successfully in the Cairns hinterland in the Mareeba and Tolga areas. On the coast north of Cairns, rice was grown in small areas around Bailey's Creek.

Records show that in 1898, 860 acres were planted to rice in Queensland, but the area steadily declined until a revival of interest in rice growing was brought about by a shortage in 1917. However, no real progress was made in developing the industry. A similar shortage followed World War 2 and interest in rice production in Quensland was renewed again.

In order to assess the possibilities of rice growing in North Queensland and with the intention of determining the most suitable varieties for the conditions, the Department began investigations at its Bureau of Tropical Agriculture at South Johnstone in 1946. Testing of varieties has continued since that date, and up to the present several useful varieties have been found. Both swamp and upland varieties have been tested side by side under non-irrigated or upland conditions.

Rice growing during recent years in North Queensland has not been confined solely to the work being carried out by the Bureau of Tropical Agriculture. Some years ago Mason Bros., of Cape Tribulation, collected seed of a variety of rice which had persisted on the creek banks north of the Daintree River since the early days of rice growing in that district. Seed supplies were increased over several years at Cape Tribulation until sufficient was available to establish a large area.

The first large-scale planting with this seed took place at Bailey's Creek, some 10 miles south of Cape Tribulation. An area of 57 acres was planted during the summer of 1949-50, but despite a promising beginning armyworms subsequently caused much damage. In 1950-51 the area sown was increased to 70 acres, but unfavourable weather depressed yields. The 30 acres sown in 1951-52 gave only fair results.

EXPERIMENTAL WORK AT THE BUREAU OF TROPICAL AGRICULTURE.

Early in 1946 a number of varieties were imported from India and Ceylon. As many of these varieties were of the swamp type, it was decided to sow multiplication plots in flood basins, where a level of water could be maintained as required. Accordingly, late-maturing swamp varieties were sown in December 1946, and the early-maturing swamp varieties in a different basin in March 1947. The upland varieties were sown in the field without recourse to flooding.

However, efforts to maintain a level of water in the basins met no success, as the alluvial gray-brown silt loam used proved to be too porous. Thus all the rice plots were actually grown under what might be termed ideal upland conditions. All the varieties except two yielded grain; the highest yield was at the rate of 21.7 cwt. of paddy per acre.

Seven varieties in this initial planting appeared promising, and in November 1947, seed-increase plots of these varieties were planted. As a result of experience with the earlier rice plots, no attempts were made to grow the rice in flood basins, but spray irrigation was used during dry spells in the early summer months.

Land around Tully was also inspected and was considered suitable for rice growing. Subsequently an area of land at Lower Tully was selected for a varietal trial. In February 1948, 1½ acres of this land were sown. The varietal trial consisted of 12 varieties, while in addition, the variety Mekeo and three Californian varieties were sown in seed-multiplication plots. The trial commenced under good conditions, but before harvest troubles were encountered, the chief being dry weather in April, infestation of lightly-sown plots with weeds, lodging of some varieties with weak straw, and loss of grain due to the presence of finches. Only six varieties were harvested, the highest yielding variety being a Ceylon swamp type, Pachchaiperumal, which yielded at the rate of 11.65 cwt. of paddy per acre.

Early in 1949 two varietal trials were laid down. One was again planted at Lower Tully, while the other was established at the Bureau of Tropical Agriculture. The trials consisted of 15 varieties, including Caluso, a New South Wales variety. Three varieties received from the Rice Branch Experiment Station of the University of Arkansas—Fortuna, Early Niro and Prelude—were also included.

The Tully trial was planted in January 1949, while the trial at the Bureau of Tropical Agriculture was delayed until the beginning of February.

Very wet weather followed the planting at Tully, and in some cases, where submergence caused a thinning-out of the stand, weeds obtained the upper hand and choked out the rice. As before, finches were responsible for considerable losses of grain. The highest yield recorded was at the rate of 11.65 cwt. of paddy per acre from the variety Mahadi. There were three complete failures; the variety Kulpi failed to germinate, complete sterility occurred in Satarsal, and Caluso was choked out by weeds.



Plate 1.

Rice Seedling Growth in a Varietal Trial at the Bureau of Tropical Agriculture.



Plate 2.

Rice Varietal Trial at the Bureau of Tropical Agriculture. Left, Tribulation. Right, Prelude.



Plate 3.

Rice Trial at the Bureau of Tropical Agriculture. Left, Kalukeenati. Right, Tribulation.



Plate 4.

Harvesting Rice with the Header-Harvester at the Bureau of Tropical Agriculture.



Plate 5.

Seed-Increase Plot of the Rice Variety Speculation at the Bureau of Investigation's Irrigation Research Station at Gatton.

The trial at South Johnstone was located on an alluvial brown silty loam soil which had a tendency to set after rain and had a low moisture-holding capacity. All varieties germinated satisfactorily, except Kulpi, which again failed. On account of the late sowing and the very cold weather experienced in June, the later-maturing varieties such as Mekeo and Fortuna failed to set much seed. Finches were responsible for some loss of grain in this trial also. The best yield was given by the variety Pachchaiperumal, at the rate of 22.5 cwt. of paddy per acre.

Experience up to this time indicated the necessity of eliminating many of the varieties from further trials because of the undesirable field characters of breaking off and lodging. Hence, the next varietal trial, planted at the Bureau of Tropical Agriculture in January 1950, contained only eight varieties. This trial included a new variety, Tribulation, which was made available by the Bailey's Creek growers, Mason Bros. The trial germinated well, but towards the end of January a plague of armyworms invaded the plots, necessitating resowing.

A second trial was established in February 1950. Prior to sowing the land was fertilized with a 5-14-5 fertilizer mixture at the rate of 300 lb. per acre. During the growing period the rice had to compete with an invasion of the tropical legumes calopo and centro. Spraying with an 0.1 per cent. solution of 2,4-D checked these plants without apparently harming the rice.

Only four of the seven varieties in the trial gave appreciable yields. The weather was too dry and cool around flowering time for the longer-maturing varieties (Mekeo, Early Niro and Fortuna) to set grain. Of the others, Pachchaiperumal recorded the highest yield, at the rate of 18.08 cwt. of paddy per acre. Caluso was stunted in growth and was overgrown with weeds, but matured rapidly, taking only 85 days. Because of its unsatisfactory performance it was considered unsuitable for further trial under North Queensland conditions. The variety Kalukeenati lodged very badly, and in addition shed its grain readily. It was considered unworthy of further trial and was also discarded. Fortuna again failed to develop any grain and it too was discarded.

Of the varieties in bulk seed increase plots, Kalukeenati lodged very badly and was harvested by the header-harvester only with difficulty. Pachchaiperumal also lodged, but not so badly as Kalukeenati; it gave the highest yield of 6.83 cwt. of paddy per acre. The variety Tribulation grew well and attained a height in excess of five feet, but rain and wind which were experienced after the crop had flowered caused one-third of the plot to lodge. Prelude exhibited rather stout straw and very little lodging occurred; moreover, the grain did not shed. The other two varieties in the bulk plots, Mekeo and Fortuna, remained erect. The former yielded 4.82 cwt. of paddy per acre, while Fortuna did not yield at all as the grain failed to develop.

Samples of paddy of a number of varieties were given milling tests. The tests showed that the grain of three varieties, Mekeo, Prelude and Early Niro, was suitable for milling.

During the 1950-51 season a varietal trial of six varieties (Pachchaiperumal, Mekeo, Early Niro, Prelude, Tribulation and Speculation), a rate-of-sowing trial, and a bulk plot of Mekeo were grown.

Prior to planting, all three areas received a broadcast application of a 5-14-5 fertilizer mixture at the rate of 200 lb. per acre. When the rice was five weeks old, an application of sulphate of ammonia at the rate of 100 lb. per acre was given.

The season was a dry one, and in the varietal trial only the two earlier-maturing varieties, Pachchaiperumal and Prelude, gave appreciable yields, 10.83 cwt. and 7.63 cwt. of paddy per acre respectively. Although Pachchaiperumal has outyielded the other varieties on several occasions, it possesses three undesirable features: the grain sheds easily, the straw is weak and lodging is common, and the grain is difficult to polish. Hence, despite its yielding ability, it has been necessary to discard this variety also. The variety Mekeo flowered irregularly under the prevailing dry conditions.

The results of the rate-of-sowing trial, using the variety Prelude, indicated that a planting rate of about 75 lb. per acre provided the optimum stand where drills were spaced seven inches apart.

Meteorological data for the Bureau of Tropical Agriculture for the seasons during which the rice experiments described above were carried out are shown in Table 1.

TABLE 1.

METEOROLOGICAL DATA—BUREAU OF TROPICAL AGRICULTURE.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average Daily Maximum Temperature (°F).													
1946 ..	87·6	88·0	88·8	84·2	79·9	74·9	75·5	78·9	82·4	84·8	87·8	87·8	..
1947 ..	93·0	87·1	85·0	83·2	77·6	75·4	76·0	76·5	79·0	81·3	85·6	87·8	..
1948 ..	86·1	85·8	86·2	82·1	79·0	74·2	73·8	74·6	80·4	86·0	87·6	89·1	..
1949 ..	88·2	86·8	82·9	78·0	76·5	72·9	71·8	74·0	77·4	85·7	88·3	89·1	..
1950 ..	88·0	87·0	87·6	80·1	80·0	75·2	75·2	75·1	78·0	83·2	86·0	82·8	..
1951 ..	87·0	86·0	85·5	85·0	78·0	77·7	74·3	77·0	77·0	83·3	85·7	89·2	..
Average Daily Minimum Temperature (°F).													
1946 ..	73·1	72·3	69·6	64·6	62·3	53·2	55·4	55·6	57·2	60·2	66·8	69·4	..
1947 ..	72·0	72·4	72·6	65·3	65·7	61·6	58·0	62·0	62·7	64·5	66·8	69·4	..
1948 ..	70·3	70·9	71·0	67·3	62·9	59·6	60·3	56·0	55·2	63·0	67·4	69·5	..
1949 ..	71·3	72·1	72·8	64·9	58·7	56·3	56·6	59·6	60·6	67·2	66·1	70·6	..
1950 ..	69·6	72·3	71·9	68·7	61·6	56·0	63·7	59·5	61·9	66·3	69·0	70·8	..
1951 ..	73·0	70·0	69·0	64·0	63·0	57·2	58·2	59·1	62·2	64·2	67·7	68·4	..
Average Daily Evaporation (Inches).													
1946 ..	·145	·152	·179	·169	·141	·109	·086	·130	·199	·215	·210	·230	..
1947 ..	·229	·132	·155	·158	·138	·094	·111	·114	·123	·180	·158	·187	..
1948 ..	·160	·144	·131	·127	·104	·108	·094	·136	·179	·203	·192	·213	..
1949 ..	·165	·162	·149	·128	·097	·086	·089	·117	·119	·161	·225	·158	..
1950 ..	·169	·175	·176	·119	·107	·092	·090	·097	·102	·157	·138	·084	..
1951 ..	·078	·109	·138	·147	·103	·093	·092	·122	·303	·154	·124	·121	..
Monthly Rainfall (Inches).													
1946 ..	24·84	35·53	16·26	4·53	7·03	1·30	1·33	0·38	0·09	0·60	1·36	5·01	98·26
1947 ..	0·47	30·14	26·53	4·68	10·15	6·62	2·48	7·28	6·04	4·05	2·66	2·07	103·17
1948 ..	39·49	10·67	18·49	11·14	2·71	8·13	5·46	4·39	0·03	0·72	0·78	6·11	108·12
1949 ..	17·42	23·40	44·28	22·19	7·49	2·27	3·59	3·11	2·96	0·76	1·65	2·30	131·42
1950 ..	17·08	16·84	34·21	31·84	2·02	7·45	7·74	1·18	4·31	2·99	16·51	33·61	175·78
1951 ..	17·55	16·23	9·79	1·81	4·65	4·03	3·61	1·02	7·11	3·22	5·58	7·38	81·98

SOIL AND CLIMATIC REQUIREMENTS FOR UPLAND RICE.

Generally, the rice crop appears to be more exacting in regard to water requirements than to soil type, although soil fertility is important. A well-distributed rainfall of over 60 inches during the growing period is essential for the successful cultivation of upland rice. All varieties thrive on rich soils well provided with organic matter. When the water-table is not high, it is desirable to have a clay subsoil that will retain soil moisture. For optimum results, rice requires about

half an inch of water daily over the growing period, with a maximum of 10 days between falls of rain. There is only one period of the year when rainfall occurs in sufficient quantities for the successful growth of upland rice on soils of low moisture-holding capacity in the wet tropical belt of Queensland, and this period extends from the end of December to the middle of April.

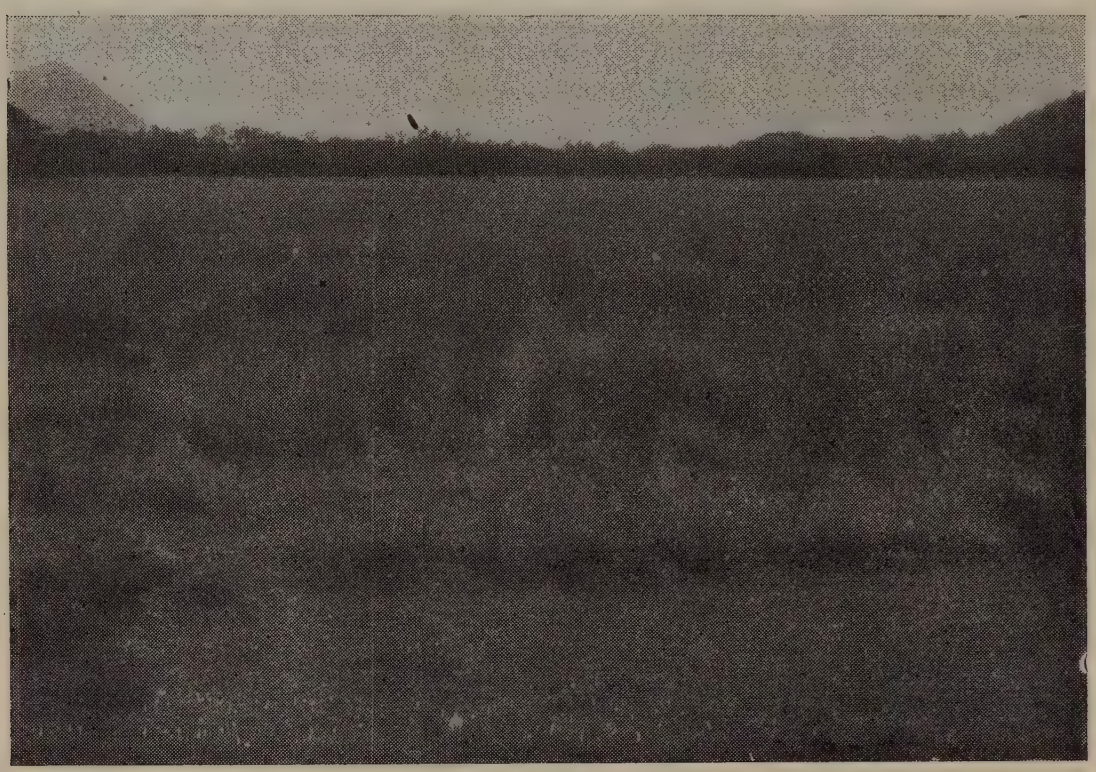


Plate 6.

Type of Land being used for Rice Growing at Bailey's Creek.

Rainfall data show that in most years it would be risky to plant upland rice in the Innisfail district before late December, as rainfall in the spring and early summer months may be low. Sowing of the crop, therefore, must be completed in January, preferably early January, before the onset of continuous wet weather, which might last for weeks. However, spells of very dry weather occur occasionally, even in January; for instance, the rainfall for January 1947 totalled only 47 points.

For best results, high soil moisture should prevail until the grain has developed. As such conditions usually occur only between January and the middle of April, it appears that a variety of the early-maturing class, such as Prelude, which flowers in 85 days, is required. A longer-maturing variety such as Mekeo would, if sown in January, flower in May, when rainfall may be inadequate to maintain moisture in soils of low moisture-holding capacity. Thus there would be a distinct possibility of a crop failure. A review of the summer and autumn rainfall data for the period 1940 to 1951 at the Bureau of Tropical Agriculture reveals that four out of the 12 years would probably have yielded poor crops of the earlier maturing varieties on the soil types available, and six out of the 12 years would probably have yielded poor crops of the later-maturing varieties. Only two years, 1941 and 1945, were considered ideal as regards rainfall for rice growing.

FERTILIZER.

Like most crops in tropical areas, rice responds to liberal applications of fertilizer. A complete fertilizer mixture of the type 5-14-5 at the rate of 2 cwt. per acre has given satisfactory results at the Bureau. Fertilizer trials with rice on an extensive scale have not been conducted in North Queensland, but it is considered that higher applications of fertilizer would achieve even better results.

Suitable crop rotations with upland rice have not been studied at the Bureau of Tropical Agriculture, but the use of leguminous cover crops appears to be very desirable before planting rice.

LAND PREPARATION.

Preparation of the seedbed for upland rice is similar to that adopted for wheat. Deep ploughing is not necessary, but the creation of a firm, moist, weed-free seedbed is most desirable for good germination and vigorous early growth of the rice seedlings. Under tropical conditions, however, where weed growth is a severe problem, deeper and more frequent cultivations are essential.

Where cover crops are used, or where there is a heavy growth of weeds, ploughing to a depth of nine inches is required. Sufficient time must be allowed for the plant remains to rot adequately, otherwise undecomposed organic matter may cause a temporary shortage of available soil nitrogen, which if not rectified by the application of sulphate of ammonia will result in crop stunting, ultimately adversely affecting yield. Cover crops should be ploughed under not later than six weeks before planting operations are due to commence. Under dry conditions, particularly with non-leguminous cover crops and weed growth, the period of decomposition would be longer.

Subsequent cultivations should aim at maintaining a clean fallow. This can be accomplished in most soils with disc cultivators and harrows. If rain falls after ploughing, however, a shallow cross-ploughing may also be necessary. The aim should be to have a weed-free, consolidated seedbed at planting time.

VARIETIES.

The number of rice varieties in existence is very large. Characters such as yield, maturation period, thickness of straw, ease of breaking, and milling qualities are all very important in selecting varieties. Trials have shown that the varieties offering best prospects of success in North Queensland under upland conditions are the short-term or early-maturing varieties. These varieties are able to make the best use of the main rain period. A disadvantage is that, in seasons when persistent heavy rainfall continues into April, harvesting difficulties will be encountered. For this reason it is essential that varieties have the capacity of retaining the grain in the panicle for a lengthy period without shattering.

Brief descriptions of the most promising varieties so far tested at the Bureau of Tropical Agriculture are set out hereunder and they are illustrated in Plates 7-12.

Speculation.

This variety is believed to have originated from seed brought into Queensland from New Guinea in 1949. It is a stout-strawed, mid-season variety taking approximately 150 days from planting to maturity. Its loose, drooping panicles yield yellow-coloured paddy. The grain is medium-round and colourless.

Mekeo.

This variety also came from New Guinea and was introduced into Queensland during World War 2. It is a late-maturing variety, taking approximately 170 days to mature its grain. The panicles are large, drooping and open, and contain yellow paddy. The grain is large and colourless. The straw is stout and slight lodging has been recorded in only one instance. Having a long growing season, it requires to be planted early for best results. Under favourable conditions it has given fair yields, but in late plantings yields have been negligible, due to faulty setting with the onset of cooler weather in the autumn.

Tribulation.

This variety was obtained from Mason Bros. in the Bailey's Creek area near Cape Tribulation. It was probably introduced into Queensland in the early days, and has become naturalized on swampy areas in the Cape Tribulation area. It is a mid-season variety, taking approximately 150 days to come to maturity. It possesses loose, drooping panicles containing yellow paddy. The grain is thin and rather long and is amber in colour. This variety yields well, but is apt to lodge.

Prelude.

This variety was introduced from the United States of America. It is an early variety, maturing in 125 days. Its loose, drooping panicles contain yellow paddy. The grain is medium-round and colourless. This stout-strawed variety resists lodging. It holds its grain well and has been the most outstanding variety tested to date.

Early Niro.

This variety was introduced from the United States of America. In North Queensland it is a late-maturing variety, taking 160 days to develop the grain. It has loose, drooping panicles possessing creamy-coloured paddy. The grain is long-round and colourless. The straw is stout and does not lodge.

SOWING.

Sowing in drills about seven inches apart to a depth of approximately one inch in the soil is desirable. The standard grain drills for wheat would be ideal for sowing rice. Broadcasting is practised on small areas, but a heavier seeding rate is required to combat weed growth. Drilling enables the seed to be placed in moist soil with ample covering to protect it from loss of moisture and the ravages of birds. Two types of drills at present in general use in wheat areas could be used for sowing rice—the disc drill, which is useful on cloddy ground, and the "combine" or cultivator-drill. These drills are fitted with fertilizer boxes so that seeding and fertilizing can be carried out in one operation. At the Bureau of Tropical Agriculture a seeding rate of



Plate 7.
Seed Panicle of Speculation.



Plate 8.
Seed Panicle of Mekeo.



Plate 9.
Seed Panicle of Tribulation.



Plate 10.
Seed Panicle of Prelude.

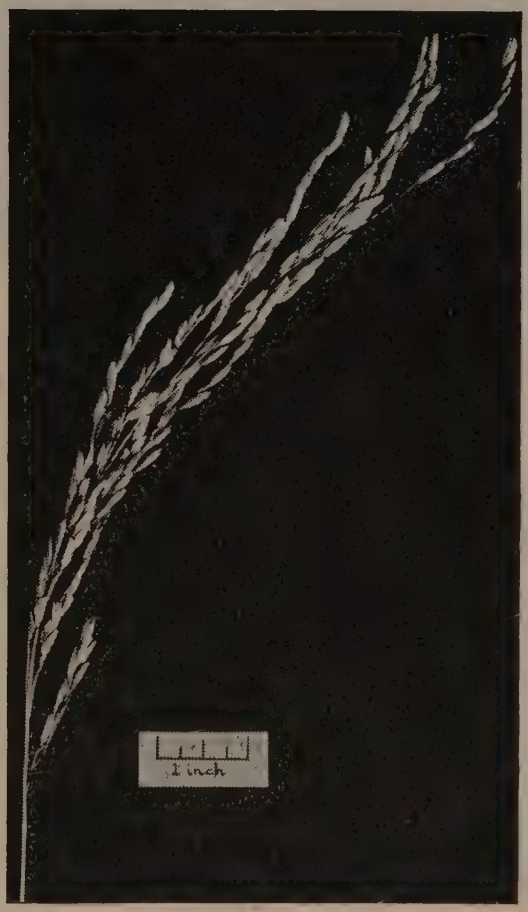


Plate 11.
Seed Panicle of Early Niro.

75 lb. per acre with Prelude has given the best results. With all varieties used in tests to date, rates of sowing lower than 70 lb. per acre appear unsatisfactory.

In Eastern countries, the general practice is to transplant seedlings of swamp rice when about six inches high, because of the greatly increased yields attributed to this method. Transplanting for commercial crops in North Queensland, however, would be uneconomic.

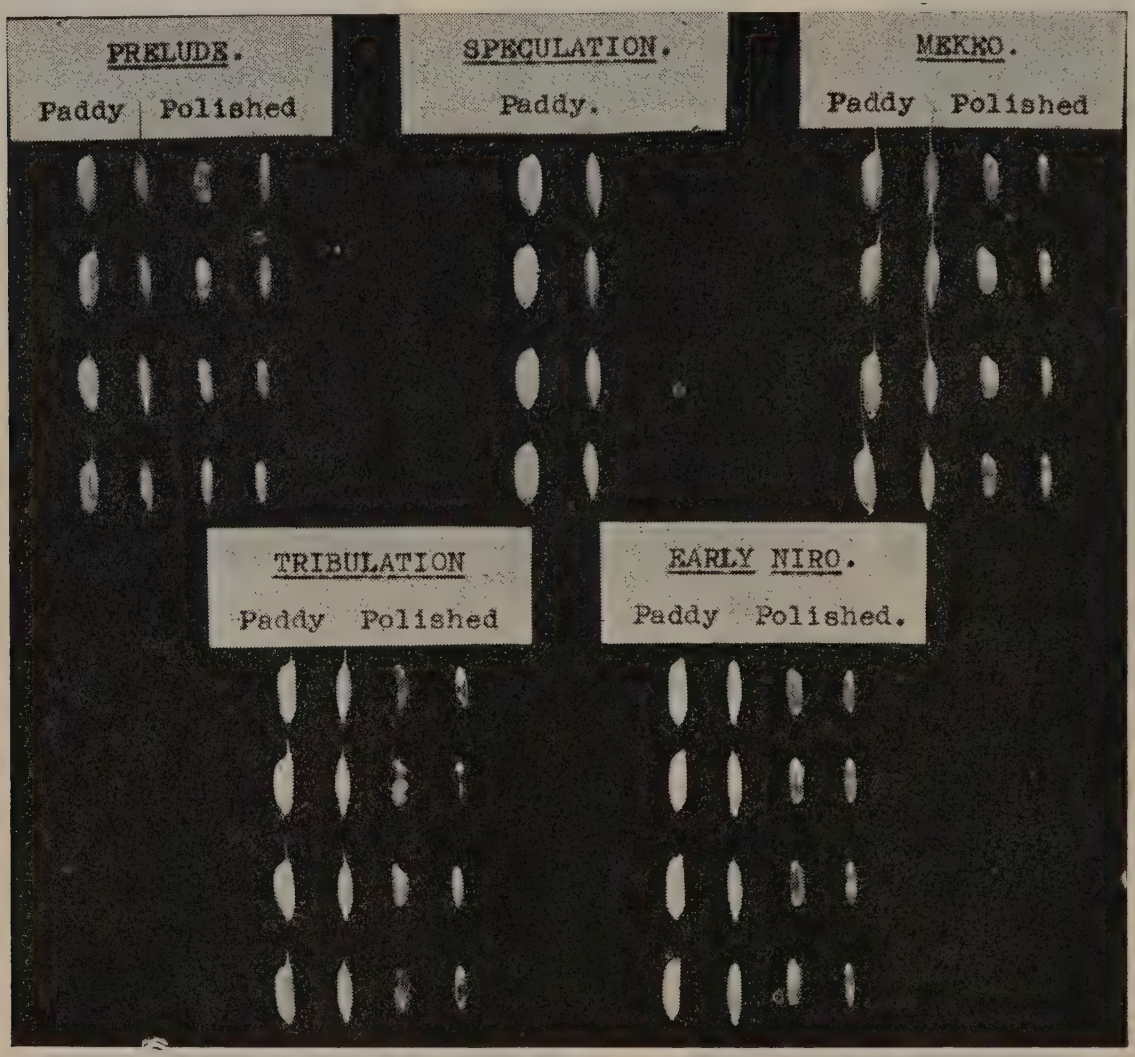


Plate 12.

Grain Types of the Five Most Promising Rice Varieties Grown at the Bureau of Tropical Agriculture.

CULTIVATION.

In rice-growing areas of the Eastern countries, where manual labour is cheap, hand-weeding is the rule. Such a method would be quite impracticable in North Queensland. However, where a good stand of seedlings has been obtained in a clean, well-prepared seedbed following drill sowing, no further cultivation should be necessary provided the field is harrowed to destroy young weed growth when the plants are about six inches high. If this harrowing is given when the crop is about one month old, the operation will not only check young weeds but will also help to thin out crowded areas and encourage tillering. Harrowing should be carried out at right-angles to the drills, preferably during the hotter part of the day, using lever harrows with the tines tilted back. If lever harrows are not available, care should be exercised to keep the harrow teeth free from soil and weeds, otherwise clumps of seedlings will be dragged out and the stand spoiled.

DEVELOPMENT OF THE RICE PLANT.

Tillering commences about five weeks from the time of sowing. The varieties under test at the Bureau of Tropical Agriculture have not tillered freely, the average number per plant in most cases being less than two; most plants have been single-stemmed. The closeness of the stand, and cultivation under non-irrigated conditions, apparently retard tillering. Following tillering, elongation of the internodes progresses and reaches a maximum when the plants are flowering. Where weather conditions are favourable, general flowering soon follows after the emergence of the first panicles from the leaf sheaths.

Flowering of the individual panicle proceeds from the tip downwards, and is completed in about seven days. The success of flowering depends largely on the weather conditions prevailing at the time. Light showers are an advantage, as the setting appears to be more even. Normally, the grain sets and passes through the milk, soft-dough and hard-dough stages to maturity some four to six weeks after flowering.

HARVESTING.

The crop is ready for harvesting when the lower spikelets throughout most of the crop show yellowing of the stem four inches to six inches below the panicles.

If the crop is harvested too early, the milling quality is lowered and the yields are reduced by the presence of immature, chalky kernels. If harvested at the dead-ripe stage, loss may be occasioned by shattering during the operation and also by a lowering of milling quality due to the fact that the kernels fracture readily.

Unlike wheat, rice matures when the greater portion of the plant is still green. Thus lodged crops are extremely difficult to harvest with a header-harvester, as the spirals have a tendency to choke readily.

The general method adopted in harvesting rice mechanically is by header-harvester direct in the field. The harvesting machinery used for wheat has been modified to prevent cracking of the rice grains by inserting rubber-lined threshing drums. Even with this modification, care must be exercised in order to ensure that the grain is not too ripe, otherwise the threshing process is likely to damage the grain. When the kernels in the lower portion of the heads are in the hard-dough stage, the kernels in the upper portion of the head are fully developed and ripe.

Overseas experience indicates that the grain should be harvested when the moisture content ranges from 20% to 27%. If harvested with less than 20% moisture there may be loss from shattering. Rice cannot be stored satisfactorily with this high moisture content, and after harvesting the rice is taken to dryers, where the moisture is gradually reduced to 14-16%.

HULLING.

When the rice comes from the harvesting machine it has two parts of the seed wrapping (the lemma and palea) closely adhering to the grain. In this form it is known as paddy or seed rice. Before rice can be consumed for human food, this seed covering or hull has to be removed. Small de-hullers readily remove the outer covering and the product is unpolished rice. Polished rice is obtained by passing unpolished rice through emery rollers, which polish off the outer coat and reduce the grains to a uniform size and colour.

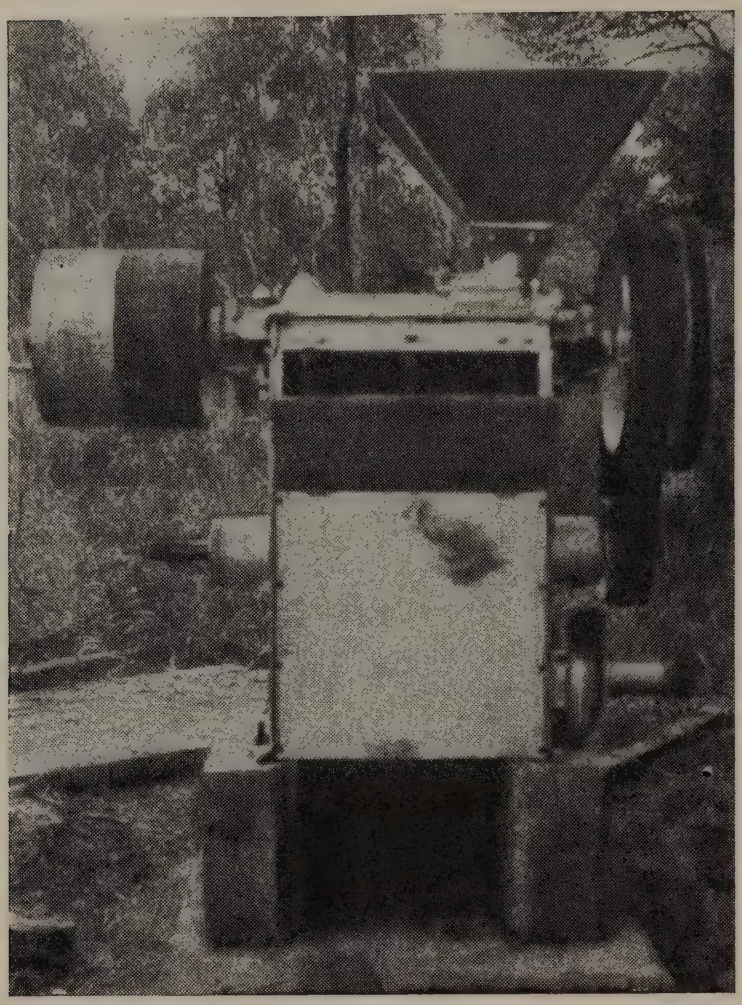


Plate 13.

Rice De-hulling Machine in use at Bailey's Creek.

In commercial rice-growing areas of New South Wales, the crop is sold as paddy by rice farmers and the husk is removed at the mills in the milling process.

THE POSSIBILITIES OF DEVELOPING UPLAND RICE-GROWING IN QUEENSLAND.

Queensland, with its vast range of climatic conditions and soil types, has land suitable for the production of rice. Seasonal conditions, however, are so variable as to render any large-scale production of this crop under non-irrigated conditions a rather risky venture. Fairly large areas would be required because of the heavy capital cost of machinery and the relatively low return per acre and to allow for the introduction of a suitable system of crop rotation. At present, in the absence of local milling facilities, transport costs would be heavy.

Under conditions similar to those at the Bureau of Tropical Agriculture, average yields of 15 cwt. of paddy per acre are unlikely to be exceeded without irrigation. Even with present prices for paddy, it would appear that upland rice growing in Queensland would not be very profitable. Individual growers who are prepared to mill their own rice may find an outlet for unpolished rice on the consumer market, but the heavy initial capital outlay on machinery and suitable land, served by good transport facilities, would be a serious obstacle.

If swamp types of rice could be grown under irrigation on soils with a high moisture-retaining capacity, and milling facilities were established within easy reach, the production of rice in Queensland could be a much more attractive proposition. Large areas of suitable soils occur in the Lower Burdekin.

Some Agricultural Features of the Central Highlands Region of Queensland.

P. J. SKERMAN, Agricultural Resources Officer, Bureau of Investigation, Department of Public Lands.

THE Central Highlands (Plate 1) comprises all of the land contained within the shires of Belyando, Peak Downs, Emerald, Bauhinia and Jericho. The total area is 37,280 square miles, or 23,859,200 acres. The Tropic of Capricorn passes through this region, and the town of Emerald, which lies more or less centrally, is 165 miles due west from the coast at Rockhampton.

The region is made up of forest ranges, lateritic red soil forest and sandy semi-desert country in the western half, and a large area of black soil open downs, dense brigalow and yellowwood scrub country, with some forest ranges and sandy soils, in the eastern half. The open downs black-soil areas are the most important, followed by the brigalow scrub country. It is estimated that there are some 2,716,240 acres of open downs country, of which 1,901,368 acres are potential arable land. In addition, some 4,577,600 acres of brigalow (*Acacia harpophylla*) and yellowwood (*Terminalia oblongata*) scrub occur; it is estimated that some 3,204,320 acres of this land would be suitable for cultivation after clearing.

Beef cattle and sheep raising have been and are still the main occupations. Beef cattle numbers total some 479,000 and sheep numbers 413,000. There has been a tendency to shift from sheep raising to cattle raising following the invasion by white spear grass (*Aristida leptopoda*) of much of the downs area.

EARLY AGRICULTURAL ACTIVITIES.

Practically all agricultural activity within the area in the past has been carried out on open downs country, the exception being a little wheat growing for green feed and hay purposes. The Department of Agriculture and Stock established the Gindie State Farm in the 1897-98 financial year and it was operated continuously until 1932. Annual reports of the activities of the farm were published, and a good deal of information has been collated from these reports.

The farm had a beef Shorthorn stud and cropping was undertaken on the open downs, using horse teams for the farming operations. Crops more or less regularly planted included wheat, barley, oats, maize, panicum, cowpeas, millet, lucerne, pumpkins, field peas, sorghums and cotton. With the limited land preparation given by using horse teams, the results of cropping varied, but the following general findings emerge from a study of the reports:—

(1) Wheat growing for hay should be successful on well-prepared fallowed land in at least two out of every three years, especially as fallowing methods with heavy machinery are an improvement on early efforts with horses.

(2) Maize growing for grain is hazardous, but for ensilage should be successful at least once in two years.

(3) Sorghum growing when tried was successful twice in every three years.

(4) Locust attack may be serious, having been reported nine times during a period of 34 years.

AGRICULTURAL SOILS OF THE AREA.

The soils so far used for agriculture have been the open downs black earths. These are self-mulching, rolling downs soils of high fertility and of good moisture-holding capacity. The soils are mostly residual in nature and derived from basalt. A "rendzina" (black soil overlying amorphous limestone) occurs at the "Chinaman" in the Angle Paddock at Peak Downs. This amorphous limestone has the following chemical analysis:—

Moisture	7·7%	CaO	23·2%
Loss on ignition	34·1%	MgO	9·9%
Fe_2O_3, &c. ..	8·2%	K_2O	0·1%
Na_2O	0·4%	Insoluble in HCl	15·9%

Neutralising Value—65·5%.

There is occasional contamination of the black earths by material derived from the rhyolites, granites and paleozoic metamorphic rocks adjoining the basalt, in which cases the soil analyses show up some possible deficiencies.

Topography influences the depth of the soil profile and it is usual to find some shallow soils of 12-18 inches in depth overlying the basalt at the crest of the ridges, deepening to 3-6 feet or more as one goes down the slopes. Fairly deep alluvial black earths occur on the creek flats—for example, of Capella, Magenta, Abor, Wolfang, Springsure, Minerva, and other creeks.

In texture classification, the black and brown soils fall in the heavy clay group, but the structure is in general excellent and the moisture-holding capacity of the subsoil would enable very effective moisture conservation during fallowing.

Chemically, the soils are generally well supplied with available phosphate, the usual figures indicating a range of 200-500 p.p.m. (below 50 p.p.m. is taken as deficient for agricultural crops). Replaceable potash is generally fair to good in all samples and calcium and magnesium are available in good quantity. Nitrogen figures are generally low but these can be greatly improved by fallowing. Successive crops of sorghum tend to reduce the nitrates fairly rapidly, and fallowing should be an integral part of the rotation.

Typical profiles from the open downs areas are as follows:—

(1) *Residual black soil—One Mile Paddock, Peak Downs—*

0– 9 in. Dark-brown clay.

9–15 in. Dark-brown clay, with limestone nodules.

15–20 in. Light-brown, mottled, dark-grey clay (rotten basalt inclusions).

(2) *Deeper residual soil—Upper Home Paddock, Peak Downs—*

0–60 in. Dark-grey to black clay.

60–72 in. Dark-brown clay.

Full chemical and mechanical analyses of typical soils are given in Table 1.

These friable black and brown soils on undulating topography are liable to erosion by storm waters and this aspect must be kept in mind in handling the soil.



Plate 1.

Sketch Map of the Central Highlands Region, Showing Agricultural Soils.

The other soils in the Central Highlands include podsolic types in the open forest ridges, residual sand ridges, lateritic red earths, alluvials of the Nogoa River, Theresa and Retreat Creeks, and an extensive area of grey and brown calcareous soils carrying a dense stand of brigalow and yellowwood scrub. Of the above, the grey and brown calcareous soils and the alluvials offer great scope for agricultural development, the former being more important because of their extent. The residual sand ridges are utilised to a small extent for citrus growing.

TABLE 1.

ANALYSES OF SOME CENTRAL HIGHLANDS SOILS.

—	Black Earth Group.										
	Gindie (near Railway Station.)			Western 3, Peak Downs.			Upper Valley, Peak Downs.			Peak Downs Homestead.	
	0–2 Inches.	2–12 Inches	12–24 Inches.	0–2 Inches.	2–15 Inches.	15–36 Inches	0–1 Inches.	1–18 Inches.	18–24 Inches.	0–12 Inches.	12–24 Inches.
pH (H_2O)	7·2	7·2	..	7·5	7·6	7·7	7·4	7·4	7·8	6·6	6·5
Available P_2O_5 (p.p.m.)	477	372	..	212	218	206	62	61	167	385	200
Replaceable Bases (m.e. per 100 g.)—											
Ca++	75·9	77·0	..	53·9	53·4	51·9	35·5	39·6	41·5	67·0	69·0
Mg++	41·6	39·4	..	32·9	32·1	32·9	27·5	27·6	29·4	25·1	24·4
Na+	0·98	0·91	..	1·49	1·57	2·55	0·62	1·11	1·65	0·37	0·30
K+	0·98	0·87	..	1·72	0·95	0·51	1·05	0·54	0·69	1·10	0·30
Total	119·5	118·2	..	90·01	88·02	87·86	67·67	68·85	73·24	92·57	94·03
Replaceable Bases (per cent. of Total)—											
Ca	63·5	65·1	..	60·0	61·0	59·0	57·0	57·0	57·0	71·6	73·4
Mg	34·9	33·3	..	36·0	36·0	37·0	40·0	40·0	40·0	26·8	26·0
Na	0·8	0·8	..	0·2	0·2	0·3	0·1	0·2	0·2	0·4	0·3
K	0·8	0·8	..	0·2	0·1	0·1	0·2	0·1	0·1	1·2	0·4
Total Nitrogen (%)	..	..	..	0·092	0·074	0·070	0·084	0·078	0·056	0·157	0·118
Organic Carbon (%)	..	..	..	0·89	0·95	0·84	0·78	0·82	0·95	0·87	0·77
C/N	..	..	..	9·6	12·8	12·0	9·3	10·5	10·7	5·5	6·5
Free Carbonates as $CaCO_3$ (%)	..	..	..	..	0·21	0·36	..	0·14	2·55	1·5	1·6
Total P_2O_5 (%)	..	..	..	..	..	..	0·025	..	..	..	..
Moisture (%)	..	..	..	13·6	14·4	15·2	10·5	11·1	10·9	12·5	11·8
Mechanical Analysis—											
Loss on Acid Treatment	..	..	..	4·10	4·20	4·4	4·4	4·3	7·6	..	..
Coarse Sand (%)	2·0	2·0	2·1	0·16	0·12	0·16	0·88	0·88	0·56	2·1	0·7
Fine Sand (%)	10·2	20·2	12·5	3·88	3·80	1·56	10·2	8·32	10·6	6·3	6·9
Silt (%)	14·6	18·6	16·2	5·0	5·0	5·0	12·5	10·0	2·5	5·1	6·1
Clay (%)	67·5	35·8	62·6	75·0	75·0	75·0	63·5	68·3	61·0	67·6	71·1
Total (%)	101·0	102·5	99·8	101·6	102·5	101·3	102·0	103·1	102·2	..	..
Texture	Clay	Clay-clay loam	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay

—	Brigalow Soils.					Brigalow-Yellowwood Scrub Soil.			Alluvial Soil.			Red Sandy Soil.	
	Weemah.			Minerva.		Emerald.			Codenwarra.			Yamala.	
	0–12 Inches.	12–24 Inches.	24–36 Inches.	0–12 Inches.	12 Inches. +	0–1½ Inches.	1½–15 Inches.	15 Inches. +	0–9 Inches.	9–14 Inches.	14 Inches. +	0–6 Inches.	6–48 Inches.
pH (H_2O)	7·0	..	..	8·1	..	7·6	8·2	..	6·5	..	..	7·1	..
Available P_2O_5 (p.p.m.)	46	..	..	168	..	28	11	..	169	..	..	56	..
Replaceable Bases (m.e. per 100 g.)—													
Ca++	20·6	..	..	21·3	..	40·1	32·1	..	12·5	..	..	4·8	..
Mg++	9·3	..	..	14·3	..	21·5	22·7	..	2·1	..	..	0·2	..
Na+	3·2	..	..	3·7	..	0·77	0·54	..	1·6	..	..	0·64	..
K+	0·42	..	..	0·31	..	0·37	0·21	..	0·92	..	..	0·48	..
Total	33·5	..	..	39·6	..	62·2	55·5	..	17·1	..	..	6·1	..
Replaceable Bases (per cent. of total)—													
Ca	61·5	..	..	53·8	..	64·4	57·7	..	73·1	..	..	78·7	..
Mg	27·8	..	..	36·1	..	34·4	40·9	..	12·3	..	..	3·3	..
Na	9·6	..	..	9·3	..	1·2	1·0	..	9·3	..	..	9·8	..
K	1·2	..	..	0·8	..	0·6	0·4	..	5·3	..	..	8·2	..
Total Nitrogen (%) ..	0·123	..	..	0·074	..	0·106	0·074	..	0·071	..	..	0·057	..
Free Carbonates as $CaCO_3$ (%)	..	..	..	3·3	..	0·15	0·68	..	..	..	..	..	..
Mechanical Analysis—													
Loss on Acid Treatment	4·0	4·1	3·9	7·7	7·1	1·8	2·8	6·2	2·4	4·0	3·2	1·0	1·3
Coarse Sand (%) ..	31·2	28·6	30·9	3·4	4·8	3·8	4·2	4·0	8·1	4·8	2·9	63·7	54·7
Fine Sand (%) ..	16·0	18·1	15·0	20·2	19·3	22·5	16·5	15·4	40·3	24·5	26·8	17·0	22·7
Silt (%)	11·5	10·1	10·4	14·7	14·5	11·9	12·7	11·9	22·5	19·1	19·1	3·0	3·6
Clay (%)	38·8	39·8	41·0	56·0	56·6	58·5	61·8	60·5	25·8	38·8	48·0	16·5	18·5
Texture	Clay loam	Clay loam	Clay loam	Medium clay	Medium clay	Medium clay	Heavy clay	Heavy clay	Loam	Light clay	Light clay	Sandy loam	Sandy loam

The alluvials are limited in extent, but those on the Nogoa River are likely to be more fully developed by irrigation. The surface soil is a grey-brown loam, overlying a grey-brown light clay at nine inches in depth.

The belt of brigalow and brigalow-yellowwood scrub grows on heavy calcareous clays which vary somewhat in their profile development. Where the yellowwood scrub dominates the vegetation, the soil surface is more friable and the soil tends towards a "brown chernosem" type. Where the brigalow dominates, the surface soil is less friable and the grey-brown, heavier-textured soil predominates. Typical profiles are as follows:—

Under Yellowwood Scrub.

Inches.	
0–1½	Brown clay mulch
1½–15	Brown heavy clay, friable
15–	Brown heavy clay, plastic

Brigalow Scrub—Weemah.

Inches.	
0–12	Dark-grey to black clay
12–36	Black clay with lime
36–48	Grey-black clay, with abundant lime
48–69	Mottled grey red-brown clay
69–	Red clay.

The chemical analyses of these soils are shown in Table 1. It will be noted that there is commonly a deficiency of phosphate in the brigalow soils, except where they are flooded, but, apart from that, they are of good fertility and of high moisture-holding capacity. The only drawback at present to their fuller utilisation is the necessity of clearing for cultivation purposes. It has been estimated that some 4,577,600 acres of this country exists in the Central Highlands alone. Throughout Queensland, some 23,000,000 acres of similar soil exists, of which 16,000,000 acres consist of dense timber untouched by the axe.

SORGHUM GROWING IN THE CENTRAL HIGHLANDS.

The present paper relates mainly to sorghum production. The climatic requirements of a grain sorghum crop are warm, moist conditions for germination and growth, with cool and relatively dry conditions for ripening and harvesting. Factors likely to be limiting in the Central Highlands area are:—

(*a*) Heat wave in January, combined with drought.
(*b*) Drought.
(*c*) Heavy midge attack in some years.
(*d*) Heavy smut infestation unless the seed is treated before planting.
(*e*) Early frosts in occasional years.

To this list might be added other factors affecting yields, such as poor germination and locust and mice plagues.

CLIMATOLOGY AND SORGHUM GROWING.

In introducing a discussion of meteorological data in relation to sorghum growing in the Central Highlands area, it must be stressed that records are not adequate to provide completely reliable information on growing seasons, daily rainfall, evaporation, frost incidence,

etc. The main deficiencies are in number of recording stations, evaporation data and figures with which a relationship between ground and screen minimum temperatures could be established.

The summary of climatological data for three towns in the Central Highlands area, shown as Table 2, has been prepared by the Commonwealth Meteorological Bureau.

TABLE 2.

SUMMARY OF CLIMATOLOGICAL DATA FOR CLERMONT, EMERALD, AND SPRINGSURE.

Factor.	Clermont.	Emerald.	Springsure.
Height above sea level (feet)	870	588	1,057
Mean maximum temperature (°F.)—			
January	93·6	94·3	93·1
July	73·0	72·9	70·9
Annual	85·2	85·6	83·8
Mean minimum temperature (°F.)—			
January	70·2	70·3	69·3
July	42·7	44·2	43·0
Annual	57·9	58·5	57·5
Mean relative humidity (9 a.m.)—			
January	61	62	60
July	66	65	58
Annual	60	61	56
Mean annual rainfall (inches)	26·7	24·5	26·0
Number of wet days annually	52	55	60

Rainfall and Sorghum Growing.

The average monthly distribution of rainfall at five centres to 1950 is as shown in Table 3.

TABLE 3.

MONTHLY DISTRIBUTION OF RAINFALL (INCHES).

Station.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rolleston	4·08	3·38	2·58	1·56	1·20	1·80	1·31	1·03	1·16	1·60	2·56	3·20	25·62
Springsure ..	4·21	3·78	2·97	1·56	1·36	1·76	1·18	0·99	1·32	1·62	2·39	3·28	26·19
Emerald	4·12	3·40	2·97	1·42	1·07	1·35	1·11	0·85	1·01	1·42	2·19	3·33	24·61
Capella..	3·89	3·13	2·61	1·26	0·89	1·52	0·90	0·55	0·81	1·26	2·23	3·40	22·45
Clermont	5·02	4·27	3·16	1·64	1·29	1·68	1·06	0·70	0·95	1·28	2·15	3·77	26·97

Years' Records—Rolleston 62, Springsure 82, Emerald 68, Capella 52, Clermont 80.

Seasonal distribution and reliability of summer rainfall are as shown in Table 4.

TABLE 4.

RAINFALL DISTRIBUTION AND RELIABILITY.

Station.	Average Distribution of Seasonal Rainfall.		Reliability of Summer Rainfall.		
	Summer Total.	Winter Total.	Chances of Receiving Less Than—		Range of Summer Rainfall.
			10 In.	15 In.	
	In.	In.	%	%	In.
Rolleston	16	8	14	42	10 to 20
Springsure	16	7	14	40	9 to 24
Emerald	16	6½	20	50	8 to 20
Capella	15	5½	25	50	6 to 20
Clermont	16	5½	14	37	8 to 24

The summer rains are made up usually of heavy storms and general rains. The storm rains are patchy. If properties are scattered throughout the region, therefore, there is a better chance of receiving a storm on at least one property than there is from having interests in one particular locality.



Plate 2.

Open Black-Soil Downs in the Gindie District. The grasses are Yabila grass (*Panicum queenslandicum*) and white spear grass (*Aristida leptopoda*).

Planting Rains.

It is assumed in the absence of actual soil moisture measurements that a minimum of 1.50 inches of rain within a week is required for sorghum or wheat planting. An examination of rainfall incidence during the 10 years, 1942-1951, showed the distribution of planting rains for Clermont, Emerald, Springsure and Rolleston to be as in Table 5.

TABLE 5.

DISTRIBUTION OF PLANTING RAINS, 1942–1951.

—	10-Year Period.	Sorghum Planting, Oct. 1–Feb. 14.	Wheat Planting, Mar.-July.
	Times.	Times.	Times.
Planting rains at all 4 centres	25	12	9
Planting rains at 3 centres only	15	7	7
Planting rains at 2 centres only	18	8	6
Planting rains at 1 centre only	24	18	4

Thus only about one-quarter of the scattered planting rains which fall throughout the area actually fall on any one property or in one locality. The figures for each of the four centres for the 10-year period are as follows:—

	10–year Period.	Sorghum Planting.	Wheat Planting.
Clermont	50	29	16
Emerald	49	26	18
Springsure	56	31	19
Rolleston	53	23	20

An analysis of planting rains at Clermont during the period 1914-1949 is shown in Table 6.

TABLE 6.

PLANTING AND GROWING SEASONS FOR SORGHUM AT CLERMONT, 1914–1949.

Week.	Average Weekly Rainfall.	Percentage of Years in which Weekly Rainfall exceeds 150 Points.	Percentage of Years in which Weekly Rainfall exceeds 200 Points.	Average Rainfall during Growing Period if Planted this Week.
	Points.			Points.
Oct. 1– 8	21	3	3	1,132
9–10	33	3	Nil	1,303
17–24	42	9	6	1,357
25–31	21	6	3	1,439
Nov. 1– 8	74	20	12	1,465
9–16	52	9	6	1,490
17–24	57	9	11	1,524
25– 2 Dec.	74	20	14	1,498
Dec. 3–10	104	26	11	1,469
11–18	77	17	14	1,385
19–26	88	23	11	1,341
27– 3 Jan.	151	26	23	1,259
Jan. 4–11	103	20	14	1,123
12–19	103	29	20	1,037
20–27	132	26	26	970
28– 4 Feb.	192	31	29	878
Feb. 5–12	87	23	20	728
13–20	124	17	17	687

It is seen that for Clermont the main break in the season comes in the last week of November, with the best rainfall period during late December and January. Planting rains may occur at any time, but the greatest chance occurs in the December-February period, when most of the planting rains are heavy falls of over two inches for the week.

Moisture for Production.

Though some general ideas regarding the amount of moisture required to produce a sorghum crop in the Central Highlands are held, the only figures available are those for soil moisture and yield compiled by J. Hart (District Agriculturist of the Queensland-British Food Corporation). After two seasons' (1951 and 1952) measurements, he showed that a minimum of 7·50 inches of rain absorbed and held by the soil was required to produce a 27-bushel crop of Kalo grain sorghum. In both seasons the crop was planted late, and the moisture required would be somewhat less than that needed by a crop growing throughout the summer months. The evaporation figure was 1·9 inches during the growing period, giving a total of 9·4 inches of rainfall absorbed. If an average runoff of 5% is added, the total rain required approximates 10 inches under the conditions which obtained.

The actual amount of rain will depend on the condition of the land surface and the intensity of the falls of rain. From the table of seasonal distribution of rains for Central Highlands centres, it will be seen that the average summer rainfall is 15 or 16 inches, so there should be a good chance of retaining 7·50 inches if the land is reasonably receptive of rain. For a higher yield than 27 bushels, more rain would of course be required. In the Land Use Map of Queensland published

in the Annual Report of the Bureau of Investigation (1949) the 20-inch isohyet was adopted as a tentative limit below which cropping would be hazardous.

The chances of receiving less than 10 inches of rainfall during the summer are given as 25% for Capella, 20% for Emerald, and 14% for Rolleston, Springsure and Clermont. Fallowing in a rotation will assist in ensuring adequate moisture for the crop, but the fallow would need to be of about 14 months' duration to enable the conservation of summer rains from one summer to the next.



Plate 3.

Partly Ring-barked Brigalow (*Acacia harpophylla*) **and Yellowwood** (*Terminalia oblongata*) **Scrub Country near Weemah.** The tussocks are tufted brigalow grass (*Paspalidium caespitosum*).

The question of what constitutes an effective fall of rain during the growing period is one which requires further consideration in the Central Highlands area. In Queensland, the application of a Precipitation/Evaporation ratio established in southern Australia is not likely to give full satisfaction in view of the fact that high precipitation and high evaporation coincide in the summer months in northern Australia. Hart, working at Springsure, is endeavouring to establish a correlation between soil moisture, plant growth and yield. The Department of Agriculture and Stock has made a number of measurements at Biloela, just south-east of the Central Highlands area, and has reported a mean yield of 45 bushels from seven varieties of sorghum on a rainfall of 1.39 in. from planting to flowering when the soil was wet to 54 in. at planting, 32 bushels on a rainfall of 4.47 in. when the soil was wet to 30 in., and 75 bushels on 9.06 in. of rainfall, with the soil wet to 45 in. at planting.

In the absence of a reliable measure of effective rainfall for sorghum in the Central Highlands area, it is not possible to make a satisfactory estimate of the reliability of effective rainfall. Department of Agriculture and Stock workers, using criteria which they considered satisfactory for the growth of native pastures, set out the percentages of reliability of effective rainfall for various localities shown in Table 7. Though they are of doubtful value in sorghum-growing studies, they suggest that the Central Highlands centres have a greater affinity with

the western Darling Downs centres (Miles, Goondiwindi) than with the Darling Downs proper (Dalby, Pittsworth, Warwick) and that cropping results would not be so good as on the Darling Downs proper. However, if land use in the Central Highlands is based on agriculture plus grazing with sheep, cattle or pigs, meteorological conditions should be sufficient to provide stability.

TABLE 7.

PERCENTAGE RELIABILITY OF EFFECTIVE RAINFALL.

Station.	4 Wet Summer Months.	4 Consecutive Wet Summer Months.	4 Wet Summer plus 2 Wet Winter Months.	2 Wet Summer plus 2 Wet Winter Months.	2 Wet Summer plus 4 Wet Winter Months.
Clermont	79	76	62	78	34
Emerald	84	79	63	72	35
Springsure	82	77	59	68	33
Dalby	93	86	87	93	63
Miles	84	79	79	89	54
Pittsworth	97	93	93	96	71
Goondiwindi	75	63	70	91	66
Warwick	99	94	96	98	80

[TO BE CONTINUED.]

Triplet Calves.

THE triplet calves shown (two heifers and a bull) were born last year on the farm of Mr. A. A. Boag (Three Moon, Monto), which is managed by Mr. W. T. Morris as a share farmer. The dam was a fairly large A.I.S. grade cow and the sire a registered A.I.S. bull. The calves were normal and healthy and are pictured below at about a week old. The heifers weighed about 55 lb. at birth and the bull about 60 lb. The cow gave birth to twin calves at her previous calving. Two other sets of twins were born on the farm during the previous few months.





TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 28th FEBRUARY, 1953.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Sunny Crest " Stud, Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman W. H. Thompson, " Alfa Vale," Nanango
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain " St. Christopher's and Iona " Studs, Brookfield road, Brisbane E. Mathie and Son, " Ainslie " Aryshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, " Glen Erin Jersey Stud," Greenmount J. F. Lau, " Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley R. J. Crawford, " Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango F. W. Verrall, " Coleburn," Walloon
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

ANIMAL HEALTH

Bloat in Dairy Cattle.

G. I. ALEXANDER, Cattle Husbandry Officer.

BLOAT or tympany is due to the sudden accumulation of large quantities of gas in the paunch. The accumulated gas causes pressure on the diaphragm, difficulty in breathing, and obstruction of the circulation; rupture of the diaphragm or rumen may occur.

Dairy cattle appear to be more susceptible to bloat than beef animals or sheep. However, all are susceptible. There are two chief kinds of bloat, acute and chronic. Acute bloat is closely related to the feeding of the animal, young legumes being most frequently the cause. It has occurred on lucerne, burr medic, red and white clovers, and field peas. Moisture on the pasture is an important predisposing cause. Non-leguminous feeds (including rapidly growing ryegrasses, cabbage leaves, potatoes, rape, beets and grain alone) have also been incriminated as causing bloat. Acute bloat has even been recorded in calves fed on milk as the sole ration.

Chronic bloat is not necessarily dependent on feed conditions and the gas formation is more moderate and continuous. It is often due to weakness in the digestive organs, such as may be caused by tuberculosis. A swallowed nail or piece of wire may penetrate the wall of the stomach and the ensuing irritation and infection may cause chronic bloat.

Symptoms and Cause of Bloat.

The symptoms of bloat vary. Acute bloat is usually indicated by the following symptoms. There develops a prominent swelling and ballooning of the left flank, which rebounds and gives a dull sound when thumped. The cow is uneasy and nervous and she no longer chews her cud. As the pressure increases, the breathing becomes laboured; the nostrils are dilated and the mouth open; and the cow moans.

The feeds which cause bloat (such as green lucerne, rape and clover) actually do not produce as much gas as do dry hay and concentrates. Gas formation is a natural process in the paunch of the cow and is due to fermentation and bacterial action. The cause of the excessive accumulation of gas which produces bloat is associated with the absence of belching by the cow. This involuntary act serves as a safety valve to permit the escape of excess gases, the stimulus for this being provided by irritation of the stomach lining. After stimulation of the stomach lining, the opening of the oesophagus into the stomach relaxes at the next contraction of the stomach and permits a quantity of gas to escape from the paunch. Hay and mature grasses contain a great deal of fibre, while green legumes and young grass have little, and it is the high fibre content of the mature grass which provides the stimulus to the

stomach lining. For this reason hungry or greedy animals are most susceptible, as they quickly consume a large quantity of the bloat-producing feed and so the gas forms much more quickly than normally and the stimulus to the stomach wall is not sufficient to produce belching.

Frequently, acute bloat is associated with the formation of a frothy mass in the paunch. This is attributed to rapid fermentation in the paunch in the presence of a substance called saponin (found in lucerne), which lowers the surface tension of the fluids in the paunch. This foamy consistency of the material in the paunch is thought to be responsible for difficulty in belching.

Preventive Measures.

Hungry stock should not be put directly onto lucerne or other leguminous pasture unless it is mature. It is a good plan to graze cattle on a grass pasture or on Sudan grass before putting them on the legume. Sudan grass is especially effective in this respect. As an alternative to grazing on grass, the cattle may be fed some hay; maize silage is also claimed to be effective. It often happens, however, that the practice of feeding stock on roughage before putting them onto a legume breaks down, as after the routine has been established the cattle will wait until they are placed on the legume and then feed greedily. Under these circumstances, it is advisable to allow only short periods of grazing on the legume at first, especially if the legume is in a young stage, and gradually increase the grazing period as the stock become used to the legume.

Cattle provided with mixed grass and legume pasture are much less likely to bloat than those on legume alone. A good mixed pasture containing approximately equal parts of legume and grass prevents bloating, but it is difficult to maintain the desired balance throughout the year, and the grazing animal cannot be forced to consume equal amounts of grass and legume.

It is claimed in connection with beef cattle that gorging on lucerne is prevented by permitting the stock free access to a paddock of grass at the same time as the lucerne is being grazed. The cattle are claimed to soon overcome their craving for the lucerne and develop a pattern of grazing grass for a period, then lucerne for a period. However, this procedure is dangerous with dairy cattle.

A useful method of preventing bloat is to place a hay rack in the middle of the lucerne pasture. The rack should be placed so that the animals have to reach up to get the hay. The paddock should not be too large, and preferably strip grazing should be carried out; the rack being moved to each strip as it is grazed.

Lucerne and other legumes should not be fed while they are moist from dew or rain; this is especially important when the crop is in the young, actively growing stage.

None of the procedures mentioned above will guarantee freedom from bloat, but they all considerably lessen the risk of its occurrence.

Treatment.

When a cow becomes bloated, she should be treated promptly. In mild cases, keeping the mouth open with a gag or piece of wood until the beast has belched most of the gas through the mouth is often useful (Plate 1).

The cow may be drenched with a mixture of 2 tablespoonfuls of turpentine and 1-1½ pints of raw linseed oil (Plate 2). This is often effective in milder cases. It is sometimes advisable to follow this treatment the following day with a laxative such as Epsom salts (1 lb. dissolved in about 2 pints of water).



Plate 1.

A Small Wooden Gag is Sometimes Used in Treating Mild Cases of Bloat.



Plate 2.

Drenching with Turpentine and Raw Linseed Oil for a Mild Case of Bloat.

A new treatment which has been found to be very effective is the use of an antifoaming agent such as "Antifoamol." Turpentine has a similar action, but has the disadvantage of destroying the micro-organisms in the paunch with which it comes in contact. The newer anti-foaming agents, which act by raising the surface tension, do not have this side-effect. "Antifoamol" may be given as a drench, 100 c.c. being diluted in a pint of water. It is more effective when injected into the paunch, but this should only be done by a veterinary surgeon (Plate 3).



Plate 3.

An Anti-foaming Agent may be Injected into the Paunch in the Same Position as Puncturing with the Trocar and Cannula is Performed.



Plate 4.

In Case of Mild Bloat, a Length of Hose May be Passed Down the Paunch to Relieve the Distension. At the same time, the forequarters of the animal should be raised by walking it onto a step.

It may be possible to relieve the distention of the paunch by getting the cow to swallow one end of a short piece of garden hose, thus permitting gas to escape through it (Plate 4). The cow's mouth may be held open by means of a wedge or piece of wood, and the forequarters raised by leading the animal onto a step.

In extreme cases the paunch may be punctured by means of a trocar and cannula. The puncture is made on the left side of the flank midway between the last rib and the point of the hip bone, and about three or four inches below the edge of the loin bones (Plate 5). The



Plate 5.

In Severe Cases of Bloat, the Paunch may be Punctured by a Trocar and Cannula.

trocar is inserted downwards, forwards and inwards, and then withdrawn gradually so as not to allow too sudden an escape of gas through the cannula. The cannula should be held firmly against the skin. When withdrawing the cannula the trocar should be re-inserted and the skin should be pushed inwards away from the cannula as it is withdrawn to prevent as much as possible the escape of fluid from the paunch. Peritonitis is sometimes a sequel to this operation and it should be attempted only in case of emergency. The wound should be treated with sulphanilamide powder to control the infection which has occurred.

A veterinary surgeon should be consulted in cases of chronic bloat, as these require specialised attention due to the difficulty in deciding the cause and the special treatments required.

Blackleg.

C. R. MULHEARN, Director of Veterinary Services.

BLACKLEG, or black quarter, is an infectious disease of calves and young cattle and to a lesser extent of sheep. It is very common in Queensland and occurs practically every year in the coastal and sub-coastal country from the New South Wales border to Townsville.

The incidence varies from year to year, and in some years only a small number of cases are detected, whilst in others the outbreaks are very extensive and widespread and occur almost in epidemic form. The disease is also seasonal, in that it is most prevalent during certain periods of the year, such as summer and autumn in southern Queensland and autumn and winter in North Queensland.

ANIMALS AFFECTED.

Calves from about 4 to 18 months old are chiefly affected with the disease, but cases also occasionally occur in young cattle up to two years old and sometimes even in older animals. All classes of animals may be affected, but the biggest and strongest calves appear to be more susceptible. Often well-grown bulls are the first animals to die. As the disease usually follows beneficial seasonal conditions, most animals are in good condition when outbreaks occur.

The disease has been reported from sheep in Queensland, and young rams appear to be most susceptible. The symptoms assume a slightly different form in sheep, and the changes are chiefly confined to the head and neck.

The disease is caused by bacteria, but it is not directly contagious from animal to animal. When a beast becomes affected the organisms multiply in certain parts of the body, and when the animal dies, as most usually do when affected with this disease, the bacteria which are present in millions through the carcase become scattered over the surrounding areas as the carcase decomposes or is broken up. The bacteria, on being exposed, form spores—that is, they become enclosed in a protective covering—and in this condition they remain highly resistant to outside agencies, such as sunlight and cold, and they continue to be infective for years. They remain in the soil, and at some subsequent period may be carried upon blades of grass or through some other agency gain entrance to an animal's body, and cause a fresh case of the disease. It is therefore easily understood how a pasture becomes contaminated and why outbreaks of blackleg regularly occur in certain paddocks. The more cases that occur, particularly if the carcases are not adequately disposed of, the greater will be the risk of infection in these areas in subsequent years.

SYMPTOMS.

The bacteria must gain entrance to the calf's body before the disease can develop, and it is thought that this may happen through injuries in the legs or lower extremities or through small abrasions in the mouth, stomach, or intestines. It is considered that the wounds on rams' heads resulting from fighting are a common means by which they gain entrance to the system in these animals.

When the causal organism enters the body it becomes established in one of the large muscle groups, such as the hindquarters, forequarters, or neck, and produces the changes which give rise to the disease.

As the disease is very sudden in onset and may kill the animal in less than 24 hours, it frequently happens that no symptoms are detected; an animal which is apparently healthy one day may be found dead the next. However, some animals may last up to 48 hours between onset of sickness and death and an occasional animal may even recover.

Fever is usually present in some degree before any change is noticeable in the animal. Dullness and depression become obvious, and if the temperature is then taken it will be found to be several degrees above normal and may be from 104° to 106° F. Muscular tremors may also be noticeable, and when the animal is moved, pronounced lameness in either the hind or forelimbs will be evident. On closer examination a swelling will be detected in one of the groups of muscles, usually in the hindquarters, but sometimes along the belly or about the forequarters. This swelling may at first be small, but within a matter of hours it becomes enlarged and extensive and is very painful. At a later stage, and usually just before death, the skin over the swelling becomes dark and dry with a parchment-like consistency. If the swelling is manipulated it will "crackle," due to the presence of gas and fluid in the underlying tissues. On being opened (an unwise procedure) a dark, frothy, sour-smelling liquid will drain away.

Following the early symptoms the animal discontinues feeding, shows dullness, rapid breathing followed by exhaustion, loss of consciousness, and death, with little or no signs of struggling. Death is actually caused by the circulation through the system of poisonous substances (toxins) produced by the bacteria within the swelling described above.

POST-MORTEM FINDINGS.

The post-mortem findings are important in connection with the diagnosis, as it frequently happens that the animals are found dead without showing symptoms, and an immediate diagnosis is desirable in order that the necessary preventive measures can be undertaken. As the disease usually occurs when putrefaction sets in rapidly, one finds the affected carcase to be badly "blown" within a few hours of death, due to the formation of gas under the skin. This causes the legs on the upper side of the carcase to extend straight out. However, if the body is closely examined it is possible to find the seat of the trouble in the form of a swelling which "crackles" under pressure of the hand. This crackling is quite distinctive and is not found in other parts of the body. If this area is opened it will be found to contain a dirty blackish, frothy fluid mixed through the tissues. The muscles are also much darker than normal, and the whole area is not unlike a bad bruise. There is a distinctive smell in this lesion which is quite different from the smell of an ordinary decomposing carcase and which has been described as resembling rancid butter. The presence of these changes in the carcase of an animal under two years is sufficient to warrant a diagnosis of blackleg and the immediate institution of preventive measures. It is not wise to open up the carcase, as the body discharges become scattered, and with them the organisms, which may give rise to outbreaks of the disease in later years. However, should the body of a recently dead animal be opened up, one usually finds up to half a gallon of bloodstained fluid in the abdominal cavity and the liver and kidneys are congested and swollen.

TREATMENT.

It is rarely possible to treat animals affected with blackleg because of the rapid course of the disease, but where possible, treatment with

penicillin by subcutaneous (under the skin) or intra-muscular (into a muscle) injection may be of value. The sick animal should be held in the shade and given ample supplies of water.

Prevention of the disease is the only effective way of controlling it and this is aimed at by (*a*) protecting the animal from being exposed to infection, and (*b*) protecting the animal by building up its resistance to the disease.

Prevention of Exposure to Infection.

The bacteria responsible for blackleg multiply in enormous numbers within the diseased animal's body, and are scattered when the carcase is opened up. The organisms form spores, which may live for very many years in the soil and still be responsible for fresh outbreaks of the disease. Unless the carcases of animals dying of the disease are properly disposed of, the soil and pastures in the vicinity become grossly contaminated with the infection, outbreaks of the disease regularly occur, and the area becomes more heavily charged with infection each year until it becomes recognised as a "hotbed" of the disease.

Whenever possible, carcases should be destroyed by burning. The carcase should be moved as little as possible and it should not be opened, as the body discharges will scatter the germs. If burning is not possible, deep burial and thorough disinfection are recommended.

Prevention by Inoculation.

This is the best method of control, and in areas where the disease regularly occurs, preventive inoculation of all young cattle should be undertaken each year.

Time to Inoculate.

Although cases of blackleg may occur at any time of the year, the disease is usually more active during the autumn and winter months; in southern Queensland this period of activity is usually reached earlier than in the north. Inoculation should be designed to give protection over this important period. The decision as to whether regular yearly or intermittent inoculations are carried out will depend on the history of the disease in the individual area.

Age to Inoculate and Duration of Immunity.

The development of immunity depends upon the reaction of a special system in the body to the products of bacterial activity introduced into the tissues by inoculation. It is considered that to achieve a full immunity, a calf should be six months old at the time of inoculation. However, it may be necessary to inoculate before this age; in this case the duration of immunity may be shorter, and it is desirable to re-inoculate if another wave of the disease appears. The immunity is achieved about two weeks after inoculation and persists for about 18 months to two years. It gradually wanes, so an animal inoculated at six months may have lost its immunity by two years. However, by this time the animal is in an age group which is not usually susceptible to the disease, though in some outbreaks older animals are affected. In such a case, it may be necessary to inoculate again at this time.

It is usually thought that inoculation gives immunity for life, but this is not the case.

Types of Vaccine.

Muscle vaccine—This is of historical interest only, but consisted of affected muscle tissue sterilized and dried, then ground into powder, suspended in water and injected.

Aggressins.—These are a refinement on the above procedure and are prepared by growing the bacteria in a culture in the laboratory. The bacteria are filtered out, leaving a clear, sterile liquid which contains the poisonous substance which the bacteria generate in the process of growth. This is called an exotoxin, and is the most powerful factor in causing death in blackleg. The aggressins may be liquid or solidified by evaporation. By introducing this substance in small quantities, the mechanism of the body which combats the poison is brought into action, and is in a state of readiness against natural infection.

Whole culture vaccines.—These are prepared in the same way as the aggressins except that the bacteria are allowed to remain in the solution and are killed by sterilization. Thus a whole culture vaccine consists of an aggressin plus the dead bacteria, and should give a more complete immunity in that a reaction is set up in the body against the poison actually contained in the bacteria, the endotoxin. This is less important than the exotoxin, but nevertheless plays some part.

Alum-precipitated whole culture vaccines.—These are whole culture vaccines to which alum has been added, and they are milky in appearance due to precipitation. This vaccine is absorbed slowly from the site of injection, and therefore should give a more lasting immunity. This is the type of vaccine prepared by the Commonwealth Serum Laboratories.

Factors causing a Breakdown in Immunity.

Age of inoculation—Inoculation of the calf when too young, before the protective mechanism is properly developed. If a calf is inoculated at three to four months of age, it may need re-inoculation in four to six months.

(*b*) *Type of vaccine.*—Any of the vaccines mentioned above should be quite effective in controlling the disease. However, the vaccine should preferably be prepared from a strain or strains of the organism similar to that which is causing losses in the area concerned.

(*c*) *Waning of immunity.*—The immunity will not last indefinitely and where an outbreak is affecting older cattle, re-inoculation of 2-year-old stock may be required.

(*d*) *Inoculation.*—The vaccine must not be too old. Information is given on the package regarding the date up to which the vaccine may be used, and this should be strictly adhered to. Care should be taken to administer the correct dose to each animal, otherwise consistent results cannot be expected.

Green Cestrum—A Plant Poisonous to Stock.

D. W. LAVERS, Veterinary Officer, Division of Animal Industry.

GREEN cestrum (*Cestrum parqui*), a shrub introduced from South America, has become a common naturalised alien in south-eastern Queensland, especially in vacant allotments around towns; it is sometimes cultivated as a hedge plant. The plant is responsible for some deaths of livestock every year and stock-owners are advised to be able to recognise it and take the necessary steps to prevent stock from eating it.

The shrub stands 4-5 ft. high and suckering occurs very freely from the base. The leaves, which have a rather offensive odour when crushed, are 2-4 in. long and on a leaf stalk of about a quarter of an inch. They are arranged alternately on the stem. The flowers are in bunches and are yellowish green, or sometimes somewhat brownish in colour. The fruits are black, shiny, and egg-shaped, about $\frac{1}{3}$ in. long, with seeds embedded in a juicy, dark-purple pulp.

Animals require only a small quantity of the plant to show some toxic effects. Horses, as a rule very selective grazers, seldom touch the plant and only a few cases of poisoning in horses have occurred Cattle and sheep, however, will eat it if fresh feed is scarce, even if they are fed on chaff. It is taken particularly in the late winter and during frosty weather. In addition, cases of poisoning have occurred in pigs and fowls.

Symptoms of Poisoning.

Affected animals are feverish and have poor appetite and increased thirst. Severe irritation to the bowel causes intense abdominal pain and a bloodstained scour, particularly in the more prolonged cases. Excitement with charging sometimes occurs, and death is preceded by a general paralysis. The rapidity of onset of these symptoms is dependent on the quantity consumed and the individual susceptibility of the animal. Usually death occurs only a few hours after the first signs of sickness appear; thus animals are often found dead without any symptoms having been seen.

Bloodstained fluid is often seen at the nostrils and the anus after death, and the carcase usually "blows up" quickly. Post-mortem examination reveals a severe gastro-enteritis, a large quantity of free blood mingling with the bowel contents. Haemorrhages occur throughout the body tissues, particularly on the outer membrane of the bowel.

Treatment of Affected Animals.

No treatment is particularly effective for poisoning by green cestrum. On general grounds, however, the use of Condy's crystals can be recommended. As much of the crystals as can be placed on a half-penny piece is dissolved in $1\frac{1}{2}$-2 pints of water and given as a drench. Immediate action should be taken, of course, to prevent access to the suspected plants by other stock either by removing them to another paddock or by erecting a temporary fence around the plants.

Eradication of Plant.

The plant is seldom particularly abundant and eradication by hand is the most effective means of control. Many types of sprays, including the non-poisonous hormone group, have been tried, but on the whole



Plate 1.

Fruiting and Flowering Stems of Green Cestrum.

have been unsatisfactory. The parent plant should be pulled out or cut off below soil level. Numerous suckers will come up from the old roots and these will have to be chipped or hand-pulled regularly until the roots become exhausted. It may take as long as five years before the plant is finally destroyed.

In south-eastern Queensland, where green cestrum grows most abundantly, stock-owners should take the greatest care to prevent trouble occurring. Paddocks, particularly vacant allotments around towns, should be carefully inspected before stock are allowed in to graze. With a little care, serious losses and expense can be avoided.

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A Preliminary Survey of Dairy Sires.

S. E. PEGG, Chief Adviser, Herd Recording Section.

THE survey of sires which was first reported in the report on pure-bred herd recording for the year 1949-50 is still in its preliminary stages, and the data up to June 1952 are reported here in the same manner as in the two previous reports.

With a view to providing a means of comparing the various sires, the average production of all recorded daughters is given, together with the average "maturity equivalent" butterfat production. The "maturity equivalent" factors used are those published in the 1950-51 report. As mentioned in that report, no factors were then available for the Ayrshire, Guernsey or Friesian breeds. This year, in response to appeals by a number of breeders and in order to give some degree of comparison, the Ayrshire bulls have been compared by the use of A.I.S. factors and the Guernseys by means of the Jersey factors. It is realised that the use of these factors is arbitrary, as there is no evidence to show that they are correct for the breeds mentioned; but, as previously mentioned, they have been used in response to appeals by breeders.

The factors used are:—

	A.I.S.	Jersey.
2-year-olds	1.40	1.35
3-year-olds	1.20	1.15
4-year-olds	1.10	1.05

It should be realised that the use of "maturity equivalent" factors will favour early-maturing animals and penalise late-maturing animals, but at present it offers a means of comparing productions at various ages.

In order to draw attention to those sires whose daughters have a "maturity equivalent" average production of 400 lb. butterfat or over, the name of the sire is printed in heavy black letters.



Plate 1.

"Valera Monarch," owned by Messrs. Sullivan Bros., "Valera," Pittsworth. This bull appears in the list of sires for the first time. Ten 2-year-old daughters have averaged 286 lb. butterfat, with a maturity equivalent of 400 lb. butterfat.

[Photo. by "Queensland Country Life."



Plate 2.

"Oatlands Duke," owned by Mr. J. N. Scott, "Auchen Eden," Camp Mountain. Sixteen of his daughters have averaged 314 lb. butterfat and the "maturity equivalent" is 426 lb.

[Photo. by "Queensland Country Life."

AVERAGE PRODUCTION OF DAUGHTERS OF SIRES.

Sire.	Herd Book. No.	Average Production of Daughters in Various Age Groups.												Average of All Recorded Daughters.					
		2-Year-Olds.			3-Year-Olds.			4-Year-Olds.			Mature.								
		Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	No.	Lactations.	Milk.	Test.	B.Fat.	Ma. Eq. B.Fat.
			Lb.	Lb.		Lb.	Lb.		Lb.	Lb.		Lb.	Lb.			Lb.	%	Lb.	Lb.
A.I.S.																			
Alfa Vale Nigel	6,439	9	7,176	291	7	7,450	302	2	8,137	307	1	11,674	445	16	19	7,410	3·99	296	378
Alfa Vale Plumber	1,345	3	7,185	294	5	6,917	287	4	8,135	345	9	8,005	317	16	21	7,742	3·95	306	358
Alfa Vale Pride 2nd	5,441	38	7,424	312	8	8,507	362	8	8,062	328	4	11,726	505	45	58	7,717	4·22	326	428
Alfa Vale Pride 3rd	4,515	14	6,398	268	6	6,400	267	4	6,978	308	1	7,976	309	22	25	6,495	4·17	271	354
Alfa Vale Re-Nell	384	12	6,945	272	10	8,022	317	5	7,690	302	3	10,692	434	24	30	7,495	3·96	297	369
Arolla Limerick	6,474	22	5,649	236	2	6,433	253	1	9,553	321	..	..	..	23	25	5,783	4·13	239	328
Bingleigh Jean's Monarch	6,579	6	7,831	365	7	9,809	409	1	5,962	217	3	11,610	445	11	17	8,635	4·31	372	468
Bingleigh Royal	6,582	3	6,574	268	3	8,321	322	5	7,252	282	1	10,583	448	10	12	7,213	3·91	282	340
Blacklands Count	3,724	17	7,266	293	9	8,624	339	2	10,047	398	3	12,496	512	26	31	8,144	4·01	327	417
Blacklands Czar	3,045	5	6,327	266	5	7,711	315	4	8,930	344	3	9,466	362	16	17	7,993	4·13	330	380
Blacklands Emblem	4,592	11	8,021	332	1	9,797	388	1	6,372	229	2	7,774	295	15	15	8,063	4·02	324	428
Blacklands Jean's Victory	5,528	12	7,344	309	3	7,646	301	..	..	..	2	9,046	374	15	17	7,507	4·17	313	414
Blacklands Prospector	37	30	7,743	302	12	8,325	317	1	7,005	277	9	11,302	466	45	53	8,238	3·91	322	416
Burradale Byron	1,258	10	10,161	389	2	14,041	514	1	9,025	367	1	10,980	403	14	14	10,693	3·45	369	540
Corunna Supreme	3,118	20	7,004	275	6	8,620	334	4	9,911	414	6	9,585	396	27	36	7,869	4·08	321	404
Dnalwon Count	2,016	7	6,026	225	3	7,847	282	2	8,342	311	2	8,917	312	13	14	7,095	3·66	260	325
Dnalwon Felix	5,639	9	6,670	237	4	7,836	276	1	8,967	284	3	10,184	367	14	17	7,361	3·61	266	334
Dulcamah Disraeli	3,150	9	5,514	231	1	8,003	326	3	7,281	321	4	8,824	354	13	17	6,501	4·20	273	333
Fairholme Lewis	6,825	9	6,355	287	2	6,257	294	..	..	..	..	..	..	11	11	6,337	4·54	288	393
Fairthorn Rainbows Prince	6,834	22	6,307	238	2	7,495	265	..	..	..	..	..	..	23	24	6,237	3·77	235	326
Fairvale Ensign	5,716	3	6,564	258	3	9,606	365	2	9,078	347	7	9,129	363	13	15	8,547	3·88	332	374
Fairvale Jellicoe	8,082	16	6,929	304	1	8,109	403	1	9,563	390	..	..	..	17	18	7,153	4·40	315	420
Fairvale Jeweller	9,324	19	5,803	239	3	6,148	269	2	7,760	335	..	..	..	20	24	6,089	3·98	243	333
Fairvale Major	4,816	8	7,106	300	6	7,758	311	6	7,519	322	13	9,571	416	23	33	7,960	4·25	338	389
Fairvale Reward	6,837	2	6,307	281	7	6,566	277	6	6,812	292	6	6,339	260	13	21	6,734	4·22	284	332
Glengallen Major	1,551	6	6,848	280	4	6,674	272	2	7,607	319	2	7,557	308	13	14	7,017	4·13	290	359
Glengarry Gems Royal	4,854	2	7,437	320	5	7,342	345	1	6,613	305	18	8,150	389	25	26	7,870	4·73	372	397
Greyleigh Eros	2,193	18	6,878	271	9	9,347	326	7	10,542	398	9	11,981	445	27	47	8,638	3·86	333	407
Greyleigh Honorarium	321	3	8,824	275	1	10,246	370	5	9,911	335	10	10,948	383	12	19	9,903	3·31	328	368
Greyleigh Valiant	666(I.)	5	9,054	341	9	10,480	403	3	10,035	400	5	9,288	359	19	22	9,676	3·88	375	448
Hillview Premier 2nd	1,653(I.)	4	6,797	270	7	7,819	314	1	9,131	343	..	..	..	10	12	7,494	3·98	298	372
Jamberoo Banner	8,299	12	5,733	235	1	7,185	306	2	5,512	206	..	..	..	13	15	5,778	4·07	235	318
Kilburnie Royalist	3,306	8	6,500	265	5	8,404	292	1	7,072	279	1	7,976	321	13	15	7,372	3·80	280	358
Kyabram Masterpiece	7,094	1	6,657	257	2	7,228	282	3	8,377	314	1	10,579	333	12	17	7,050	3·77	266	346
Midget's Sheik of Westbrook	1,511(I.)	27	6,972	281	9	8,117	337	1	6,944	319	8	7,853	309	37	45	7,167	4·07	292	368
Mountain Camp Joker	5,979	17	5,292	210	2	6,159	240	..	..	..	..	..	..	17	19	5,362	3·97	213	295
Murray Bridge Florrie's Prince	7,210	4	6,671	273	4	7,631	318	6	9,339	353	3	8,786	361	12	17	8,039	3·95	318	372

Navillus Prince Henry	6,013	5	6,480	320	8	7,304	288	6	8,417	336	7	10,248	393	18	26	7,814	3·93	307	356
Newstead Musician	8,476	6	6,755	281	3	7,930	300	..	..	..	1	8,724	333	10	10	7,304	4·00	292	378
Newstead Reliance	5,080	10	7,164	309	9	7,600	319	3	9,021	383	1	9,386	357	20	23	7,578	4·24	321	408
North Glen Emblem	2,522	14	7,491	295	7	8,168	338	5	8,978	354	2	14,604	542	17	28	8,077	4·04	326	414
Parkview Highbrow	6,077	6	6,531	266	2	7,946	328	2	7,861	324	1	10,411	382	10	11	7,161	4·07	292	372
Parkview Limerick	5,110	24	6,861	270	6	9,026	366	3	10,759	401	2	9,658	395	27	35	7,495	3·95	296	388
Patrol of Cosy Camp	1,258(I.)	3	7,218	284	2	6,789	256	3	9,076	355	6	9,954	384	11	14	8,559	3·89	333	376
Penrhos Blossom's Prince	2,577	5	8,265	322	3	6,217	265	2	8,569	334	3	8,207	390	11	13	7,634	4·07	311	374
Penrhos Pansy's Pride	4,265	7	9,809	425	10	11,543	500	3	11,307	492	4	13,994	578	21	24	11,364	4·27	485	578
Penrhos Pansy's Prince	3,455	15	6,693	260	8	5,683	238	..	..	..	6	7,894	325	24	29	6,599	4·00	264	337
Reward of Fairfield	1,769	27	9,270	380	18	11,093	464	12	13,077	552	32	14,188	585	45	89	11,197	4·12	461	535
Rocklea Comet	8,627	12	5,803	213	..	..	..	1	4,463	180	..	..	..	12	13	5,807	3·67	213	296
Ronnoc Emblem	7,409	5	7,099	307	4	6,619	271	5	6,441	264	7	8,545	339	20	21	7,272	4·11	299	347
Rosenthal Lilac 4th's Emblem	7,426	7	6,752	282	1	6,150	274	2	7,720	303	1	7,590	319	11	11	6,949	4·14	288	371
Rosenthal McArthur	8,461	14	6,125	241	5	5,818	231	2	4,823	191	..	..	..	19	21	5,960	3·93	234	319
Rosenthal Musketeer	5,214	11	6,764	267	3	7,269	297	1	11,981	503	3	8,726	362	14	18	7,555	4·06	307	387
Rosenthal Pendant's Prince	564	18	5,655	225	7	6,540	261	5	7,323	288	8	9,553	410	36	38	6,953	4·07	283	340
Rosenthal Perfection	5,216	7	6,525	261	3	7,519	305	4	8,996	336	7	7,975	347	15	21	7,678	3·97	305	357
Rosenthal Surplus 2nd	683	6	5,990	245	9	8,332	334	4	9,682	394	3	9,661	389	16	22	7,765	4·02	312	376
Rosenthal Surprise	5,222	7	5,893	241	3	7,412	304	..	..	..	1	6,643	342	10	11	6,442	4·02	259	343
Sunlit Farm King Billy	4,376	12	6,480	271	1	7,519	298	1	7,402	289	1	9,903	364	15	15	6,972	4·02	280	373
Sunlit Farm Madam's Victory	8,686	12	6,596	258	..	..	..	1	9,324	366	..	..	..	12	13	6,823	3·91	267	356
Sunnyview Artist	3,535	19	5,841	242	2	8,024	333	3	7,667	335	1	8,729	389	22	25	6,278	4·19	263	349
Sunnyview Commodore	2,752	6	9,245	372	4	13,045	557	..	..	..	3	9,408	401	13	13	10,452	4·16	435	538
Sunnyview Kitchener	7,488	5	9,920	418	3	8,701	355	1	9,652	366	1	12,572	519	10	10	9,793	4·12	404	522
Sunnyview Royal National	7,493	8	6,890	273	5	7,988	347	4	7,993	331	1	9,185	386	16	18	7,210	4·09	295	375
Sunnyview Spearvale	8,704	10	7,064	276	8	8,453	332	4	7,771	321	..	..	..	22	22	7,698	3·96	305	385
Tabbagong Victory	8,729	33	6,654	265	8	8,938	308	..	..	..	..	..	..	29	41	6,741	4·11	277	368
Tara Governor	6,297	9	7,046	263	2	9,282	332	1	11,013	378	3	10,570	384	12	15	8,183	3·65	299	379
Trevlac General	2,889	14	6,513	253	5	6,286	297	2	8,692	367	..	..	..	20	21	6,535	4·04	265	350
Trevor Hill Bosca	5,351	27	7,332	299	7	8,307	335	9	8,315	338	9	10,182	419	39	52	7,619	4·04	308	393
Trevor Hill Progress	5,353	12	6,386	264	1	7,494	308	..	..	..	..	..	..	12	13	6,479	4·14	268	374
Trevor Hill Reflection	3,583	19	6,844	290	15	7,498	307	8	9,326	320	8	7,987	350	41	51	7,593	4·20	319	393
Valera Daphne's Prince 2nd	7,588	6	4,926	188	3	6,106	227	4	6,308	231	1	6,503	251	12	14	5,494	3·77	207	258
Valera Monarch	10,054	10	6,806	286	..	..	..	..	..	..	..	..	..	10	10	6,806	4·20	286	400
White Park Ronald	3,607	7	5,898	236	3	5,702	236	2	8,770	373	3	9,118	369	11	15	7,053	4·04	285	339
AYRSHIRE.																			
Benbecula Marquis	11,670	9	4,912	197	4	7,078	278	4	8,304	320	2	8,658	340	15	19	6,041	3·95	239	302
Benbecula Bonnie Willie	9,479	4	9,193	347	9	9,176	354	1	6,535	292	3	10,021	360	13	17	8,975	3·84	345	420
Crescent Farm Bell Boy	12,557	11	6,739	268	..	..	..	..	..	..	..	..	..	10	11	6,739	3·99	268	340
Myola Bessemer	11,224	10	5,447	214	6	7,278	282	3	5,949	237	5	6,906	285	18	24	6,082	4·01	244	294
Myola Jellicoe	10,568	15	6,107	249	17	6,647	265	8	7,217	394	13	7,027	283	44	53	6,670	4·05	270	326
Myola Perfection	11,936	9	5,665	230	2	5,895	289	1	6,788	253	..	..	..	11	12	5,835	4·16	243	327
Oatlands (Q.) Dan	11,941	7	6,483	274	3	7,412	331	3	8,188	357	..	..	..	10	13	6,928	4·27	296	388
Oatlands (Q.) Duke	11,230	13	7,059	308	5	6,033	249	..	..	..	..	..	..	16	17	7,257	4·33	314	426
GUERNSEY.																			
Fairfield Winner	4,857	10	5,151	241	10	6,291	288	10	6,175	298	4	6,547	302	28	34	5,929	4·69	278	318
Laureldale Pluto	4,211	1	5,928	285	3	6,001	282	3	5,206	272	9	6,051	310	12	16	5,833	4·51	263	313
Laureldale President	1,944	5	6,094	282	2	5,859	317	1	12,125	550	5	8,216	407	10	13	7,060	4·83	341	392
Laureldale Pride	8,832	27	4,906	228	4	5,158	226	..	..	..	..	..	..	29	31	4,968	4·61	229	306
Linwood Hurricane	8,845	17	5,353	247	1	5,344	261	2	6,410	293	..	..	..	16	19	5,398	4·63	250	329
Minnamurra Topsey's Sequel 2nd	5,095	12	6,400	324	9	6,719	348	4	9,285	435	9	8,047	409	22	34	6,733	5·03	339	402
Warrawong Winter	4,535	16	6,432	306	11	6,428	314	4	7,784	345	6	6,196	279	28	37	6,483	4·78	310	382

AVERAGE PRODUCTION OF DAUGHTERS OF SIRES.

Sire.	Herd Book. No.	Average Production of Daughters in Various Age Groups.												Average of All Recorded Daughters.					
		2-Year-Olds.			3-Year-Olds.			4-Year-Olds.			Mature.								
		Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	Lactations.	Milk.	B.Fat.	No.	Lactations.	Milk.	Test.	B.Fat.	Ma. Eq. B.Fat.
			Lb.	Lb.		Lb.	Lb.		Lb.	Lb.		Lb.	Lb.			Lb.	%	Lb.	Lb.
JERSEY.																			
Aerofoyle of Banyule	3,181	3	5,794	293	3	6,505	352	2	7,616	402	4	8,516	496	10	12	7,003	5·49	385	431
Austral Park Double Blue	15,633	18	5,362	281	3	7,621	405	2	3,682	214	1	6,361	326	20	24	5,632	5·26	296	390
Avon Real Star (Imp.)	16,488	12	4,950	263	4	6,330	319	1	6,566	332	..	..	..	13	17	5,219	5·27	275	357
Belgonia Flashlight	15,354	15	4,739	246	3	4,757	249	..	..	..	..	..	..	17	18	4,741	5·19	246	344
Belgonia Lady's Duke 2nd	9,513	16	5,580	277	1	5,453	262	3	5,549	293	3	8,170	413	20	23	5,963	5·03	300	374
Belgonia Peggy 9th's Duke	7,429	14	5,114	258	3	6,465	339	1	3,910	207	..	..	..	14	18	5,118	5·10	261	343
Bellgarth Stylish	10,878	13	5,861	328	8	6,081	343	11	6,300	347	23	7,033	396	18	55	6,237	5·56	347	400
Belmont Royal Peer	15,243	22	4,064	201	1	4,594	224	..	..	..	..	..	..	22	23	4,062	4·97	202	271
Brampton Daffodil's Peer	11,760	13	4,599	249	2	5,150	283	2	5,878	299	5	6,509	346	15	23	4,970	5·45	270	337
Brooklands Merry Monarch	13,940	12	5,427	283	2	5,443	279	1	8,393	452	..	..	..	11	15	5,603	5·05	283	337
Brooklands Regalia	14,490	16	5,280	292	3	6,171	343	2	6,811	364	1	6,338	319	16	22	5,570	5·49	306	394
Bulby Maria Keepsake	16,366 (J.S.B.A.)	14	5,868	303	9	5,407	292	5	7,091	398	5	7,567	399	18	33	5,773	5·21	301	370
Bulby Oxford Gamboge	12,025 (J.S.B.A.)	5	6,601	336	5	7,578	374	3	7,572	387	3	5,982	299	11	16	6,996	4·92	344	411
Burnlea Aviator 4th	8,317	1	5,105	256	7	5,329	258	3	5,870	287	1	6,589	314	10	12	5,523	4·83	267	304
Calton Lothean	9,615	6	6,547	320	4	7,187	377	4	7,328	365	6	7,791	393	14	20	7,088	4·98	353	406
Devon Park Maderia's Victorious	15,744	33	5,224	303	4	6,601	414	..	..	..	1	7,599	387	38	38	5,432	5·84	317	416
Glenside Lone Star	9,721	5	6,131	312	1	6,579	327	1	7,860	451	8	8,466	392	12	15	7,338	4·93	362	408
Glenview Royal Chief	13,956	12	4,941	241	3	5,697	301	5	6,825	348	2	3,952	239	17	22	5,293	5·03	266	326
Hunstrete Emperor's Volunteer (Imp.)	6,457	..	..	..	..	..	..	..	..	..	11	7,955	455	11	13	7,955	5·72	455	455
Inverlaw Observer	15,436	17	5,043	255	2	6,465	321	..	..	..	..	..	..	18	19	5,106	5·05	258	343
Jersey Lea Golden Duke	13,831 (J.S.B.A.)	21	4,793	267	15	5,455	316	5	5,903	315	23	5,992	323	27	64	5,196	5·60	291	337
Lawn View Teddie	16,460	12	4,620	223	2	5,407	256	..	..	..	..	..	..	14	14	4,733	4·82	228	293
Lermont Volunteer	8,658	17	4,077	211	3	5,108	283	3	5,794	353	1	4,954	249	18	24	4,315	5·40	233	294
Masterpiece Yerribee of Bruceville	3,292	7	5,299	277	5	5,728	305	4	6,428	344	9	7,793	426	17	25	6,491	5·28	343	382
Maurfield Larkspur's Gift	9,632	9	6,195	330	5	7,579	377	1	6,942	349	8	8,192	405	16	23	7,207	5·06	365	427
Mornmoot Clementines Valour	12,092	10	6,192	295	4	5,977	288	3	6,913	347	2	9,373	488	18	19	6,494	4·86	316	382
Navua Ladoras Ruler	10,249	6	5,880	349	4	6,472	373	6	5,687	363	4	5,975	335	18	20	6,097	5·95	363	421
Navua Victorious Samaritan	13,167	6	4,591	244	5	4,842	265	3	5,801	314	1	6,553	353	12	15	4,960	5·36	266	321
Oxford Ajax	11,553	7	6,243	312	3	6,524	351	..	..	..	2	7,550	432	10	12	6,354	5·19	330	410
Oxford Asters Lad	8,129	5	4,927	301	5	7,537	354	2	6,496	314	7	7,275	360	18	19	6,612	5·13	339	384
Oxford Brown Victory	6,162	8	5,650	290	2	5,022	292	2	5,495	339	6	4,778	251	13	18	5,128	5·30	272	328
Oxford Daffodil's Victor	11,016	10	6,188	347	4	8,141	467	2	8,539	459	5	6,386	399	20	21	6,668	5·74	383	409
Oxford Fawn's Noble	14,530	15	5,775	321	4	6,633	375	4	5,733	321	..	..	..	16	23	6,015	5·50	331	428
Oxford Fawn's Victor	12 605	17	5,415	282	3	4,927	313	4	6,008	298	1	6,669	364	18	25	5,313	5·14	273	345

Oxford Flying Fox	15,501	8	4,634	243	5	5,807	315	2	7,146	403	..	..	..	13	15	5,324	5·37	286	350
Oxford Franklyn	16,005	12	5,926	293	1	5,808	300	..	..	..	..	..	..	13	13	5,916	4·95	293	391
Oxford King Peter	15,273	9	4,768	259	1	3,651	177	1	4,978	246	..	..	..	10	11	4,635	5·33	247	332
Oxford Noble Peer	9,124	8	4,912	282	4	5,709	330	1	7,321	436	5	6,475	364	11	18	5,296	5·64	299	366
Oxford Peer	7,361	17	5,717	313	4	6,167	332	..	..	..	1	7,315	385	19	22	5,829	5·51	321	420
Oxford Pixie's Victor	10,837	16	5,422	287	3	5,941	302	3	6,637	336	4	6,578	320	19	26	5,564	5·19	289	368
Oxford Royal Lad	8,001	27	5,888	315	8	6,849	362	7	7,341	389	2	7,209	338	37	44	6,106	5·26	321	399
Palm Ridges Golden Victory	14,704	8	4,932	277	2	5,269	319	1	4,017	274	1	7,115	385	11	12	5,158	5·78	298	382
Retford Earl Victor	3,655	11	7,349	380	3	6,931	392	6	7,261	374	8	8,101	392	18	29	7,205	5·14	370	430
Retford King's Thorn	5,115	12	6,170	325	5	7,286	411	3	8,319	464	8	8,168	449	26	28	7,246	5·44	394	455
Retford May's Victor	5,286	9	6,141	336	2	6,051	345	2	8,373	503	8	7,745	411	12	21	6,682	5·31	355	418
Retford Royal Atavist	7,066 (J.S.B.A.)	28	4,607	254	2	5,377	307	1	10,115	590	10	8,927	492	37	41	5,614	5·54	311	377
Rosel Solid Gold	11,813	1	5,525	309	3	4,169	234	7	4,584	262	8	6,219	328	17	19	5,237	5·50	288	293
Samares Cute Prince 3rd (Imp.)	8,876	8	6,423	345	3	8,615	427	3	8,134	416	3	7,657	416	13	17	7,023	5·24	368	437
Selseys Royal Standard	12,093	3	6,117	332	7	6,040	312	2	5,579	291	3	7,032	329	12	15	6,195	5·18	321	369
Selseys Samares Hallmark	11,722	27	5,419	288	2	6,320	363	2	6,320	363	2	6,298	364	26	32	5,423	5·38	292	384
Trecarne Butter Queen's Officer	10,218	10	4,263	239	2	5,377	311	2	4,852	270	6	5,307	298	10	20	4,508	5·61	253	311
Trecarne Golden King 2nd	11,233	14	5,422	335	4	6,641	404	2	6,136	400	3	6,422	399	18	24	5,718	6·17	353	436
Trecarne Golden Lad 2nd	14,944	7	5,590	284	7	5,330	271	2	7,538	414	..	..	..	13	16	5,641	4·49	253	345
Trecarne Renown 2nd	5,546	24	4,947	264	10	6,639	357	4	6,546	343	3	7,173	379	27	41	5,361	5·47	293	363
Trecarne Royal Officer	12,999	18	3,770	212	3	5,074	290	1	6,528	315	..	..	..	18	22	3,974	5·53	220	288
Trecarne Some Duke	11,850	25	4,937	266	17	5,286	284	10	6,062	316	16	6,358	335	37	68	5,631	5·31	299	353
Trecarne Some Tots Duke 2nd	14,241	19	4,854	264	4	5,453	304	1	7,061	379	..	..	..	14	24	4,871	5·48	267	349
Trecarne Some Victor 4th	12,781	9	4,931	269	5	5,188	287	..	..	..	2	5,252	289	14	16	4,943	5·52	273	336
Trecarne Victor 4th	11,492	31	4,986	253	12	6,078	309	9	6,293	328	6	7,275	376	30	58	5,717	4·76	272	326
Trinity Ambassador	2,834	18	5,793	325	8	7,169	428	5	6,546	367	7	6,903	375	24	38	6,058	5·56	337	403
Trinity Crowning Effort (Imp.)	12,311	24	5,177	273	7	7,252	383	8	7,591	384	13	7,422	370	36	52	6,091	5·15	314	372
Trinity Cute Commodore	11,101	8	7,490	369	7	7,735	391	3	8,013	394	3	6,881	345	19	21	7,589	4·97	377	462
Trinity Daffodil's Effort	13,747	24	6,675	315	3	7,195	372	4	8,424	372	1	7,523	356	26	32	6,922	4·75	329	421
Trinity Gleaming Effort	15,002	14	5,572	298	3	6,320	353	..	..	..	..	..	..	11	17	5,609	5·40	303	399
Trinity Golden Royal	10,760	17	4,906	268	8	6,150	337	3	6,460	347	11	6,248	339	25	39	5,642	5·44	307	371
Trinity Governor's Hope	5,730	43	5,684	292	19	7,537	382	6	7,357	398	22	8,189	417	55	90	6,334	5·13	325	395
Trinity Graceful Duke	14,575	20	4,697	257	2	5,319	308	..	..	..	..	..	..	18	22	4,787	5·45	261	370
Trinity Irondele's Effort	14,240	7	4,353	210	3	6,320	235	..	..	..	..	..	..	10	10	4,350	5·01	218	280
Trinity Mighty Prince	13,678	18	4,908	264	2	6,212	323	3	6,319	323	4	5,818	299	22	24	5,316	5·25	279	344
Trinity National Victory	12,309	9	5,261	282	5	6,822	348	1	8,263	390	2	7,051	313	16	17	6,292	4·94	311	386
Trinity Noble Effort 2nd	13,323	24	4,478	245	8	5,660	308	3	6,033	367	..	..	..	24	35	5,276	5·36	283	348
Trinity Popcorn 2nd's Pioneer	6,952	4	5,814	299	1	5,503	343	4	5,564	280	3	6,013	311	10	12	5,753	5·16	297	343
Trinity Royal Prince	10,756	6	5,251	259	4	5,999	304	1	5,172	263	1	6,567	349	12	12	5,603	5·03	282	343
Trinity Royal Sovereign	8,180	7	5,587	276	2	6,238	299	1	4,073	238	6	6,751	348	15	16	5,961	5·00	298	354
Trinity Some Officer	6,798	7	5,428	314	9	6,666	390	8	7,443	439	22	6,625	379	21	46	6,403	5·79	371	410
Vinchelez Golden Victory (Imp.)	4,943	15	4,395	256	6	5,025	304	..	..	..	6	5,279	279	18	27	4,749	5·69	270	335
Westbrook Aster's Lad 39th	11,654	4	4,077	216	6	4,891	250	..	..	..	..	..	..	10	10	4,565	5·17	236	295
Westbrook Aster's Lad 44th	11,865	1	2,396	98	1	3,176	163	4	4,288	212	14	4,347	226	20	20	4,179	5·12	214	219
Wheatlands Jester (Imp.)	6,950 (J.S.B.A.)	2	5,544	268	3	7,364	387	1	10,379	615	7	7,526	411	11	13	7,077	5·28	374	403
Woodside Golden Volunteer	6,366	65	5,118	269	16	6,335	337	6	6,346	344	12	7,183	383	66	99	5,407	5·25	284	363
Woodview Officer	14,025	12	3,765	205	2	5,604	309	..	..	..	..	..	..	12	14	4,015	5·38	216	290

When examining production records, it is essential to consider the conditions under which the records are made. It must be realised that the standard of herd management and the plane of feeding play a very important part in determining the production of animals. When selecting animals for the herd, the farmer should endeavour to select animals with production records produced under conditions similar to those existing on his own farm. In the past much disappointment has been experienced because the animals were selected on account of high production records which were made under artificial or extremely favourable conditions, totally dissimilar from those existing on the property on which they were subsequently used.



Plate 3.

"Tabbagong Victory," with Ten of His Daughters, all owned by Mr. M. C. Lester, "St. Andrews," Glengallan, Warwick. Twenty-nine of this bull's daughters have averaged 277 lb. butterfat ("maturity equivalent" 368 lb.).

[*Photo. by "Queensland Country Life."*

PESTS AND DISEASES HANDBOOK.

The second edition of Volume III of the "Queensland Agricultural and Pastoral Handbook" is now available from the Department of Agriculture and Stock.

The description and control of pests and diseases which affect most of the farm and orchard crops grown in Queensland are set out. There is also a chapter on insecticides and fungicides and one on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for fifteen shillings, post free in the British Commonwealth.

The Bacteriological Content of Dairy Farm Utensils Cleansed with Approved Detergents.

W. F. SCHUBERT, Biochemist, Dairy Research Branch.

AN investigation designed to obtain information on the bacteriological condition of dairy farm utensils cleaned with approved detergents was carried out during 1951 on selected farms in the Caboolture district and on the Darling Downs. The water supplies on the Caboolture farms were relatively soft, whilst those on the Darling Downs farms were chemically hard. One milk-supply farm (Farm A) and three cream-supply farms were selected for the trials.

The equipment used on the milk-supply farm comprised a 4-unit milking machine, a 40-gallon milk vat, a milk strainer, a beehive cooler, four 8-gallon cans, and sundry buckets.

The equipment in use on the cream farms consisted of a 4-unit milking-machine, a 40-gallon milk vat, a cream separator, 8-gallon cans, and sundry buckets.

On all farms the equipment was in good physical condition.

Cleaning Techniques.

The cleaning routines used were as follows:—

Farms A, C, D.

(1) A cold (atmospheric temperature) water rinse of all equipment immediately after milking.

(2) Treatment with a detergent solution at a temperature of 160-180°F.

(3) Treatment with hot water at 200°F.

(4) A hypochlorite (200 p.p.m.) pre-rinse of all equipment before the commencement of the next milking.

Farm B.

The general routine was the same as on farm A with the following exceptions:—

(1) A warm (110°F.) water rinse was used immediately after milking in place of the cold water rinse.

(2) A warm (110°F.) water pre-rinse was substituted for the hypochlorite pre-rinse.

On farms C and D the routine was similar to Farm A.

Sufficient detergent to last four weeks was made up and the farmers concerned instructed in its use by a practical demonstration. Weekly visits were then paid to the farm and the following samples taken:—(1) rinses of all utensils except the cream separator; (2) teat rinses of the first eight cows to be milked; (3) samples of the first milk to pass over the utensils.

Methods of Rinsing.

(1) *Milking machine.*—The cluster was disconnected from the end unit and the rinse water sucked directly through the machine. The rinse was collected at the releaser.

(2) *Clusters.*—The clusters were rinsed five times with the same rinse water.

(3) *Milk vat.*—The rinse solution was poured into the vat and the vat then rotated so that the rinse water made contact with the whole surface. The rinse solution was collected through the tap.

(4) *Milk strainer.*—The rinse water was poured directly through and collected from beneath.

(5) *Milk cooler.*—The rinse water was poured onto the top of the cooler and collected at the outlet.

(6) *Milk can.*—The rinse water was poured into the can, the lid replaced and the can placed on its side on the ground. The can was then rolled forward six turns and then back six turns. It was restored to the vertical position and the rinse solution poured into the lid and then into a sterile container.

(7) *Milk bucket.*—As for milk vat.

(8) *Teats.*—The udders of cows on the milk-supply farm were first washed with a hypochlorite solution (1,000 p.p.m.); in the case of cows on the cream-supply farm, warm water was used. Each teat was then allowed to dip into the rinse solution for an instant.

(9) *First milk over utensils.*—Samples of the first milk through the machine, in the milk vat, through the milk strainer, over the milk cooler and in the can, were collected in sterile containers.

Detergents Used.

The following detergents were used:—

Farm A.

(1) Soda ash + wetting agent (3:1 mixture)—2 oz. per 4 gallons of water.

(2) Detergent-Sanitiser—$1\frac{1}{2}$ fl. oz. solution A + $1\frac{1}{2}$ fl. oz. solution B per gallon.

(3) Caustic soda—$\frac{1}{2}$ oz. per 4 gallons of water.

(4) Washing soda + wetting agent (3:1 mixture)—4 oz. per 4 gallons of water.

(5) Sodium metasilicate—2 oz. per 4 gallons of water.

Farm B.

(1) Trisodium phosphate + cationic surface active agent (9:1 mixture)—2 oz. per 4 gallons of water.

(2) Washing soda—4 oz. per 4 gallons of water.

(3) Trisodium phosphate—2 oz. per 4 gallons of water.

(4) Sodium metasilicate—2 oz. per 4 gallons of water.

(5) Proprietary wetting agent—$\frac{1}{2}$ oz. per 4 gallons of water.

(6) Hot water (180°F.).

Farm C.

A mixture of—

Soda ash	19 lb.
Sodium metasilicate	5½ lb.
Trisodium phosphate	7 lb.
Teepol	8 lb.
Water	40 gallons

One and a-half pints of the mixture was used to 4 gallons of hot water.

Farm D.

A mixture of—

Soda ash	25 lb.
Trisodium phosphate	7 lb.
Teepol	8 lb.
Water	40 gallons

One pint of the mixture was used per 2 gallons of hot water.

It will be noted that in a few cases the detergents have been duplicated. This was done because the detergents gave what was considered to be either very good or very bad results on the first trial. Of the detergent-sanitisers used, one was a proprietary line and the other was prepared in the laboratory. The mixtures of alkalies and wetting agents used were those recommended by the manufacturers of the wetting agents. One trial was run with hot water (180°F.) in order to test the efficiency of this agent alone. No build-up of soil was observed on the equipment during this trial.

Discussion of Results.

A summary of the results of the trials is given in Tables 1 and 2. In most instances the number of colonies of bacteria per unit volume of rinse is of the same order for each utensil. This indicates that the results are more a reflection of technique than of the merit of the individual detergents used. Hence it is not possible to compare the relative bacteriological efficiencies of the detergents.

From Table 3, in which are set out the average values, it will be noted that the milk vat, the milk cooler, and the milk can for farms A and B gave relatively high results. On farms C and D, where hard water supplies were used in conjunction with mixed detergents, the principal sources of contamination were located in the milking machines and milk vat. This suggests that these utensils are the least efficiently cleaned on the farm.

The results indicate that if the udders are efficiently washed, there is only a small contribution of bacteria from this source, and then only to the first milk.

The conclusion is reached that if proper methods are employed, it should be possible to produce milk on Queensland farms with a colony count of less than 50,000 per millilitre.

TABLE 1.

SUMMARY OF RESULTS OF INDIVIDUAL DETERGENTS*.

——	Farm A—Milk Farm.					Farm B—Cream Farm.						
	Soda Ash + Wetting Agent.	Detergent Sanitiser.	Caustic Soda.	Washing Soda + Wetting Agent.	Sodium Metasilicate.	Trisod. Phosphate + Cationic Surface Active Agent.	Washing Soda.	Tri-Sodium Phosphate.	Sodium Metasilicate.	Wetting Agent.	Hot Water.	Means.
Clusters	377	60	561	TNC	TNC	164	80	216	154	278	1,740	241
Milking Machine	17,700	2,570	4,980	TNC	TNC	1,080	1,050	537	1,440	206	907	1,490
Vat	18,700	7,080	2,110	33,300	TNC	902	1,470	2,300	4,050	4,170	17,800	3,990
Strainer	516	1,810	149	266	490	..	..	..	..	..	..	518
Cooler	2,530	2,530	7,990	TNC	TNC	..	..	..	..	..	..	3,710
Can	13,000	171,000	41,200	TNC	5,720	7,760	9,720	2,360	2,600	1,060	3,040	8,020
Bucket	69	202	48	109	241	105	28	254	219	186	225	118
Teat Rinses	11,300	12,400	10,100	TNC	TNC	5,630	6,330	9,440	6,820	8,360	27,600	9,640
First Milk through Machines ..	56,600	26,900	59,200	45,200	41,400	3,630	3,160	6,560	6,680	3,870	16,300	11,400
Milk in Vat	41,900	35,800	48,100	36,900	27,200	1,880	4,120	14,400	10,200	4,900	19,600	12,200
Milk through Strainers	61,300	33,900	42,900	26,900	43,400	..	..	..	..	..	..	44,700
Milk over Cooler	52,200	32,200	56,600	28,300	43,400	..	..	..	..	..	..	45,600
Milk in Can	47,900	28,500	44,900	27,400	26,200	..	..	..	..	..	..	38,800

* Geometric Means.

NOTES.—TNC = No. geometric mean determined because colonies were too numerous to count in the majority of determinations.

.. = No determinations were made.

In the washing soda + wetting agent and sodium metasilicate trials on Farm A (milk farm) hot water was not used at the evening wash-up owing to a technical fault in the hot water system.

TABLE 2.

SUMMARY OF RESULTS OF MIXED DETERGENTS.

	Farm C.	Farm D.	Geometric Mean.
Bucket	1,134	5,181	2,262
Vat	19,920	19,860	19,890
Milking Machines	60,290	8,702	25,010
Separator	940	5,255	2,055
Milk Can	372	1,054	526

TABLE 3.

GEOMETRIC MEANS OF ALL RESULTS.

Utensils.	Colony count per ml. of rinse.	
	Average Farms A and B.	Average Farms A, B, C and D.
Clusters	241	..
Milking Machine	1,490	2,300
Milk Vat	3,990	5,108
Milk Strainer	518	..
Milk Cooler	3,710	..
Milk Can	8,020	5,274
Milk Bucket	118	186
Teat Rinses	9,640	..
First Milk	..	..
Through Machine	11,400	..
In Vat	12,200	..
Through Strainer	44,700	..
Over Cooler	45,600	..
In Can	38,800	..

Technical Data.

Volumes of Rinses Used.

The rinse water used was the buffered distilled water recommended by "The Standard Methods for the Examination of Dairy Products" of the American Public Health Association (ninth edition).

In cases where hypochlorite solutions were used on the farm, the thiosulphate inactivator was added to the rinse water.

The volumes of rinse water used for the individual farm utensils were as follows:—

Utensil.	Volume of Sterile Buffered Distilled Water Used.
Milking machine	1,000 ml.
Clusters (each)	500 ml.
Milk vat	200 ml.
Milk strainer	100 ml.
Milk cooler	200 ml.
Milk can	200 ml.
Milk bucket	100 ml.

Media.

Colony counts on the rinses were made on tryptone-glucose-meat extract agar with incubation at 30 °C. for 48 ± 3 hours.

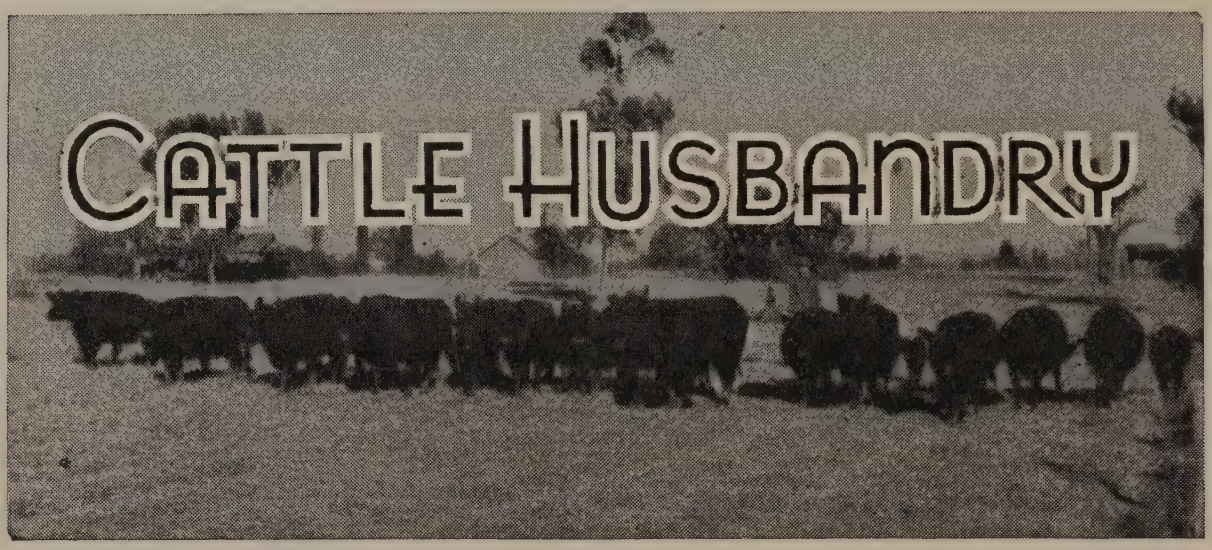
Colony counts on the milk were made on tryptone-glucose-meat extract-skim milk agar with incubation at 30°C. for 48 ± 3 hours.

References.

American Public Health Association. Standard Methods for the Examination of Dairy Products. Ninth Edition.

Acknowledgment.

The investigations outlined above were conducted on demonstration farms from funds provided by the Commonwealth Dairy Industry Efficiency Grant and the assistance of field officers employed under the grant is acknowledged.



A Calf-Branding Crush and Cradle.

J. J. SULLIVAN (Senior Adviser) and J. G. YOUNG (Husbandry Officer), Cattle Husbandry Branch.

THE management of a cattle property is efficient or otherwise according to the method of handling the cattle. Where cattle are concerned, the most efficient operations are those which are carried out as quickly and as quietly as possible with the greatest economy of labour and with the least possible distress to the cattle.

The old methods of calf branding adopted on many Queensland properties entailed a considerable amount of excitement, noise and wasted energy on the part of both the stockman and the calf, but these old methods of scruffing and man-handling or bronchoing are rapidly being replaced by more efficient methods.

Today, efficient station managers in southern and central Queensland will not tolerate the waste of energy and unnecessary ill-usage of young cattle, and the branding cradle has been installed on many properties. Its advantages are such that in an emergency, not uncommon in these days of labour shortage, the entire branding operation can be carried out quite promptly, and without undue effort, by a man and a boy. It is without doubt one of the most valuable labour-saving devices available to the industry. Any design of a new yard for handling mixed cattle should not be considered complete without this unit, and it can usually be added as an appendage to an already constructed yard in such a way that no drastic alterations are needed to the original. However, in all circumstances it is important to remember that the yard used to hold the calves after branding should be used for this purpose only, so that a clean, dust-free enclosure is available to the calves at a critical time.

CALF CRUSH.

The calf crush and branding cradle described here is a convenient type. From the pound a gate opens into a V-shaped calf-pen, which, as shown in Plate 1, is provided with a gate which can close at three positions so as to keep the calves well packed up. At the entrance to the calf crush is a slide gate, and at the other end another slide, through which the calf passes to the waiting pen, and then into the cradle.

The following specifications may be adopted for the crush:— 8 ft. panels from centre to centre of posts; 8 in. posts, 6 ft. 9 in. long, 3 ft. in ground, 3 ft. 9 in. out; 4 in. rails; top rail morticed in flush with the top of the post; 2nd rail 15 in. from top of post; 3rd rail 27 in.

from top of post, all morticed flush with post; width of crush 14 in. at ground level, 17 in. at top of top rail; length of waiting pen 4 ft. 9 in.; space allowed for installation of the branding cradle at the end of the waiting pen 5 ft. 6 in.

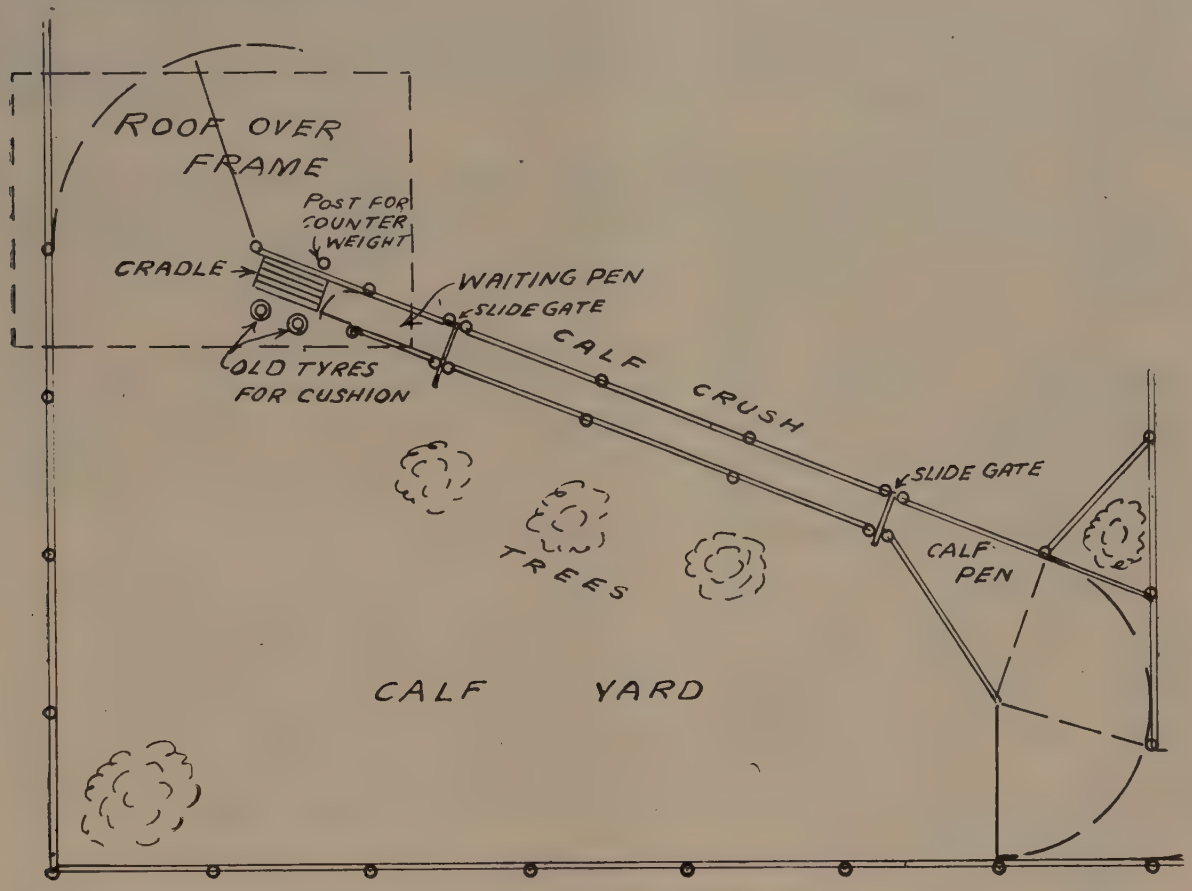


Plate 1.

Plan of a Calf-Branding Crush with Cradle.

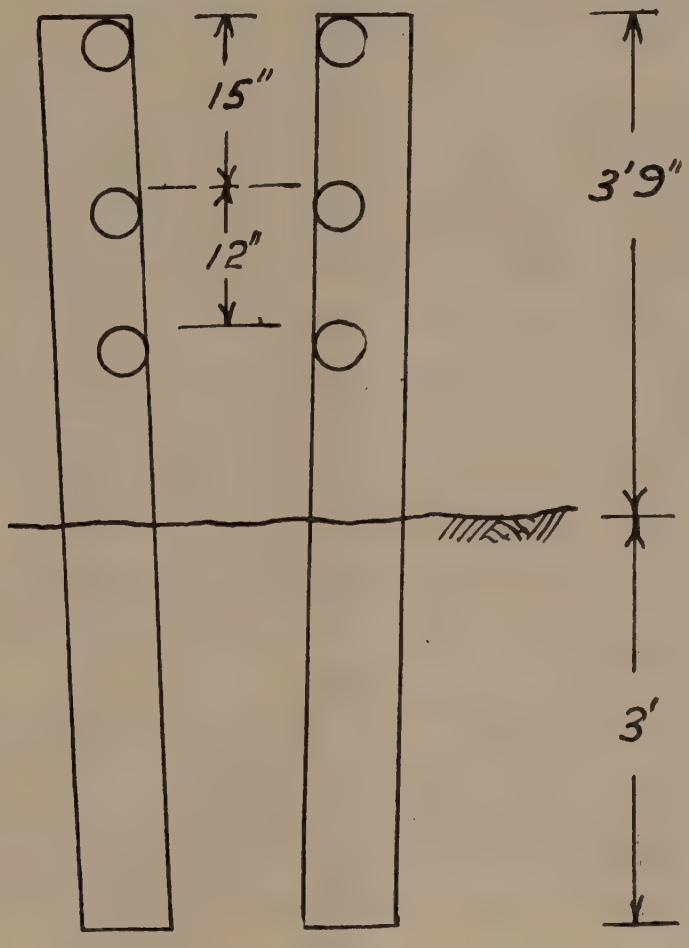


Plate 2.

Section Through Calf-Branding Crush.

A STURDY CALF-BRANDING CRADLE.

The cradle described and illustrated in Plates 3-9 was constructed by Mr. V. M. Hayes of "Kerry Downs," near Emerald, from materials which he had available on his property. The machine was built in his own workshop, using carpentry and blacksmithing tools and facilities usually found in the average station or property workshop. The electric welding on the trigger-release mechanism was the only work done outside the home shop.

The machine embodies some novel features of construction which make for speed and ease of handling, and although metal is used considerably in its construction, it compares more than favourably in weight with the more common wooden types.

A notable feature of Mr. Hayes' machine is the pivotting on the central hinge, providing such balance that even the largest calves, 12 months of age or more, can be thrown off their feet with a minimum of effort when caught properly in the cradle. The machine is extremely sturdy and well braced against the thrust of the calf and the jarring caused when calf and cradle are thrown over.

With care in the selection of timber and materials and proper maintenance, this cradle would be reasonably expected to "last a lifetime." The only maintenance needed would be the withdrawal of the central hinge after use and the storage of the two halves of the machine under cover. The assembly process takes no more than one or two minutes. A cause of much damage to many machines, particularly types with an all-wooden frame, is the weight of the calf stamping on the lower frame when being released.

The machine drawn and described is for branding on the near side. However, it should be readily possible to construct a similar cradle for off-side work from the illustrations.

The timber used in the construction of the cradle is spotted gum (*Eucalyptus maculata*), a useful hardwood for tool handles and other purposes where resistance to jarring and shocks is needed. The four "bows" were originally 4 in. x 2 in. x 40 in. long; they were dressed down to the required shape with saw, chisel and plane and finally rounded on the inside faces and edges with a spokeshave. The four "bows" are all approximately the same size and shape.

The larger half of the cradle (Plate 3), upon which the calf lies when thrown to the ground, is a solid piece of metal about an eighth of an inch thick. Actually, in the machine described a section of discarded cattle water-troughing was used; it was curved slightly to fit the shape of the bows with an approximate 1 in. camber at the extreme top and 1½ in. at the extreme bottom.

A length of half-inch angle iron is rivetted to the rear edge of the metal sheet for added strength and to present a blunt edge to the approaching calf.

The section is solidly braced with a flat iron bar (1 in. x ¼ in.) from the bottom of the rear "bow" to the top of the front "bow."

The metal sheet continues for about 2 in. below the bottom of the "bows" and is in close proximity to the central hinge bolt. In the model described the space between sheet and hinge bolt is only about half an inch. Calves have on occasions sustained leg fractures in models

where this gap has been wide enough to allow the animal to place a leg between the bottom edge of the frame and the hinge. If unnoticed by the operator, the leg is invariably broken when calf and machine are thrown to the ground.

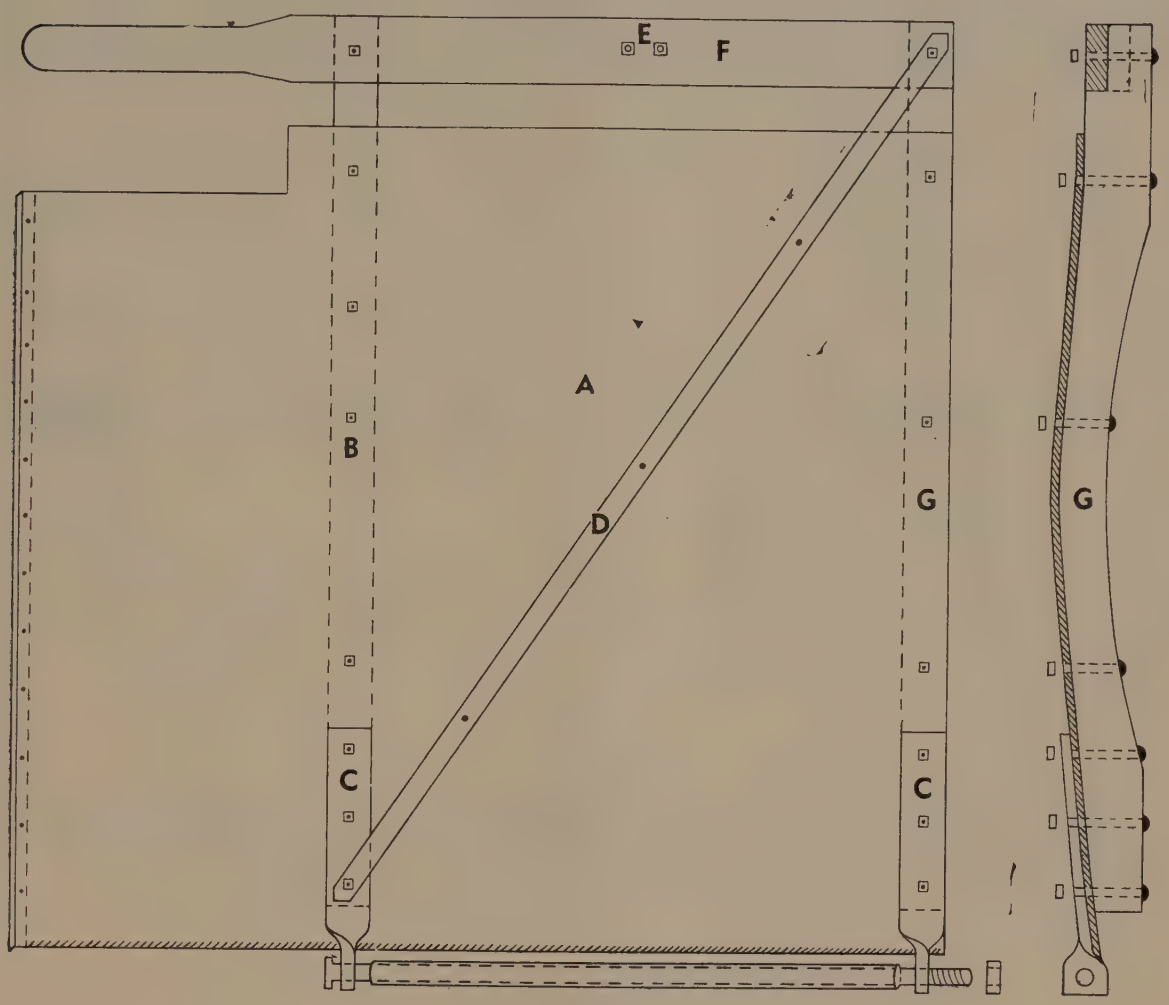


Plate 3.

Lower Section of Cradle—Underneath View. A. Metal base 42" × 37" with one corner cut out and rear edge strengthened with half-inch angle iron rivetted on. B. Rear bow. C. Steel strip 2" × ½" shaped at end to hold hinge pin. D. Iron or steel brace 1" × ¼" held by ¼" tank bolts. E. Metal D. F. 3" × 2" spotted gum cross-piece. G. Front bow, shaped from a 40" length of 4" × 2" spotted gum. The metal base of the cradle and the steel strip connecting the hinge pin are shown in the view at the right.

The smaller or top half of the cradle (Plate 4) is an open frame consisting of two "bows" similar to those on the other half, and opposing them when the machine is assembled. Three cross-pieces, morticed into the "bows" and fixed with countersunk ⅜ in. bolts, run horizontally between the "bows." In the case of the two 3 in. x 2 in. cross-pieces at the top of each half of the cradle, the mortice is halved or shared between the "bow" and cross-piece for added strength and rigidity, whilst the other cross-pieces are simply morticed 1-1½ in. into the "bows."

The machine pivots on a ¾ in. hinge bolt approximately 30 in. long, with a ¾ in. spacer bar (piping) used to counteract any movement of one half of the frame relative to the other. The "hooks" attaching the frames to the hinge pin are of 2 in. x ½ in. metal and were turned and shaped as illustrated. Each is secured to the bottom of the "bow" by three ⅜ in. bolts.

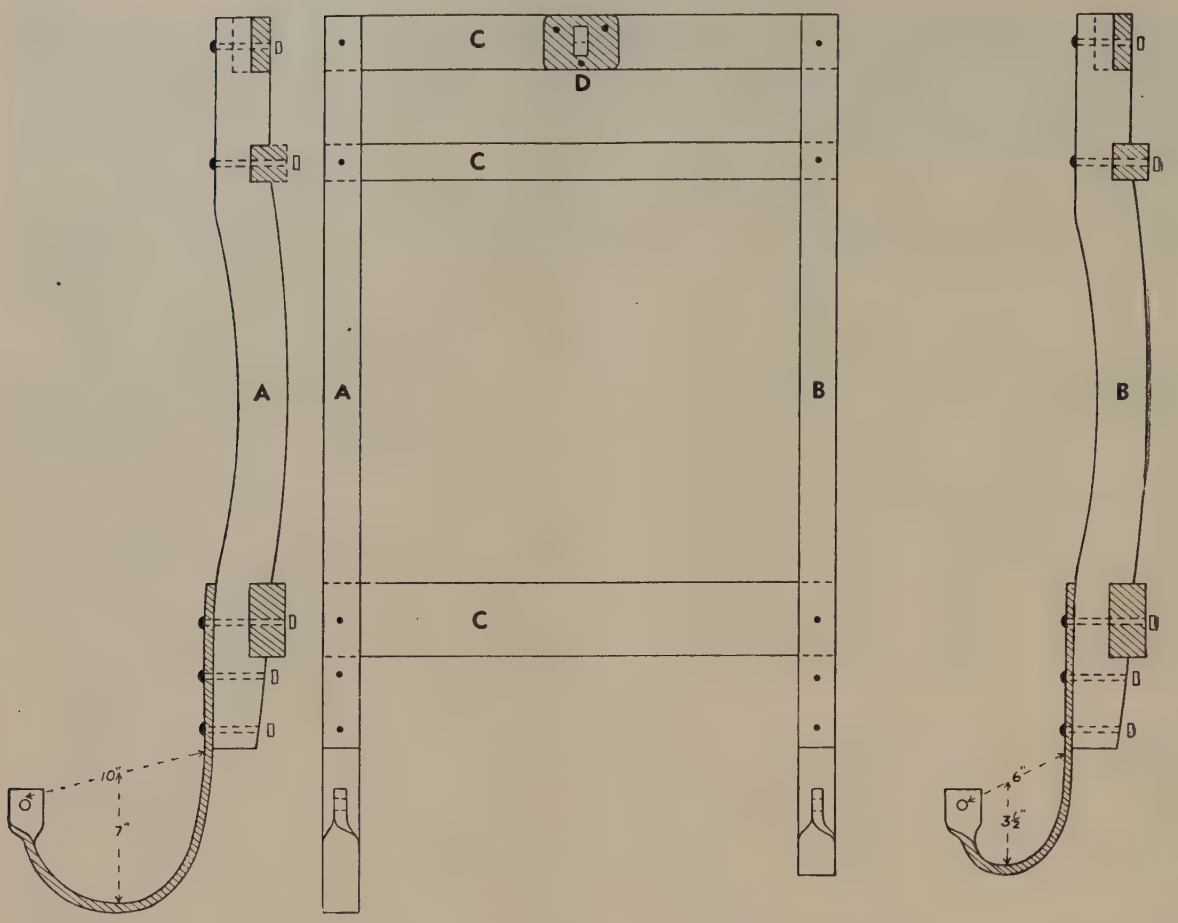


Plate 4.

Upper Section of Cradle. The cradle, which is 28" wide, is shown from underneath in the centre, and the rear and front bows are shown at left and right, respectively. A. Rear bow. B. Front Bow. C. Cross-pieces 3" × 2", 2" × 2" and 4" × 2". D. Metal plate 4" × 3" with keyway 1¼" × ¾" for ratchet or sword.

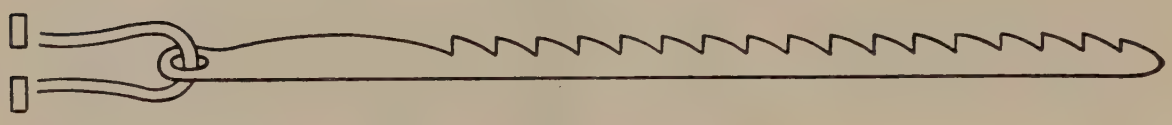


Plate 5.

Ratchet or Sword. This is a 24" piece of 1" × ½" steel with 18 teeth.

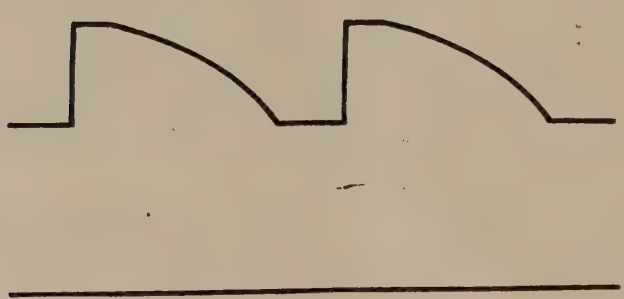


Plate 6.

Individual Teeth of Ratchet or Sword. Each tooth is ⅜" deep and has a ⅛" flat area on the top and a ¼" flat area in the well.

The ratchet (Plate 5) was made from a piece of steel 1 in. x $\frac{1}{2}$ in. and approximately 2 ft. long. The serrations were cut as shown in Plate 6. The features are an $\frac{1}{8}$ in. "flat" on the top of the teeth to minimise the wear which occurs if these teeth are pointed and a $\frac{1}{4}$ in. flat area in the well of the serration in which the pawl snugly fits. The pawl utilizes, thus, the full depth of the serration, and wear, especially in the middle section of the ratchet, is kept to a minimum.

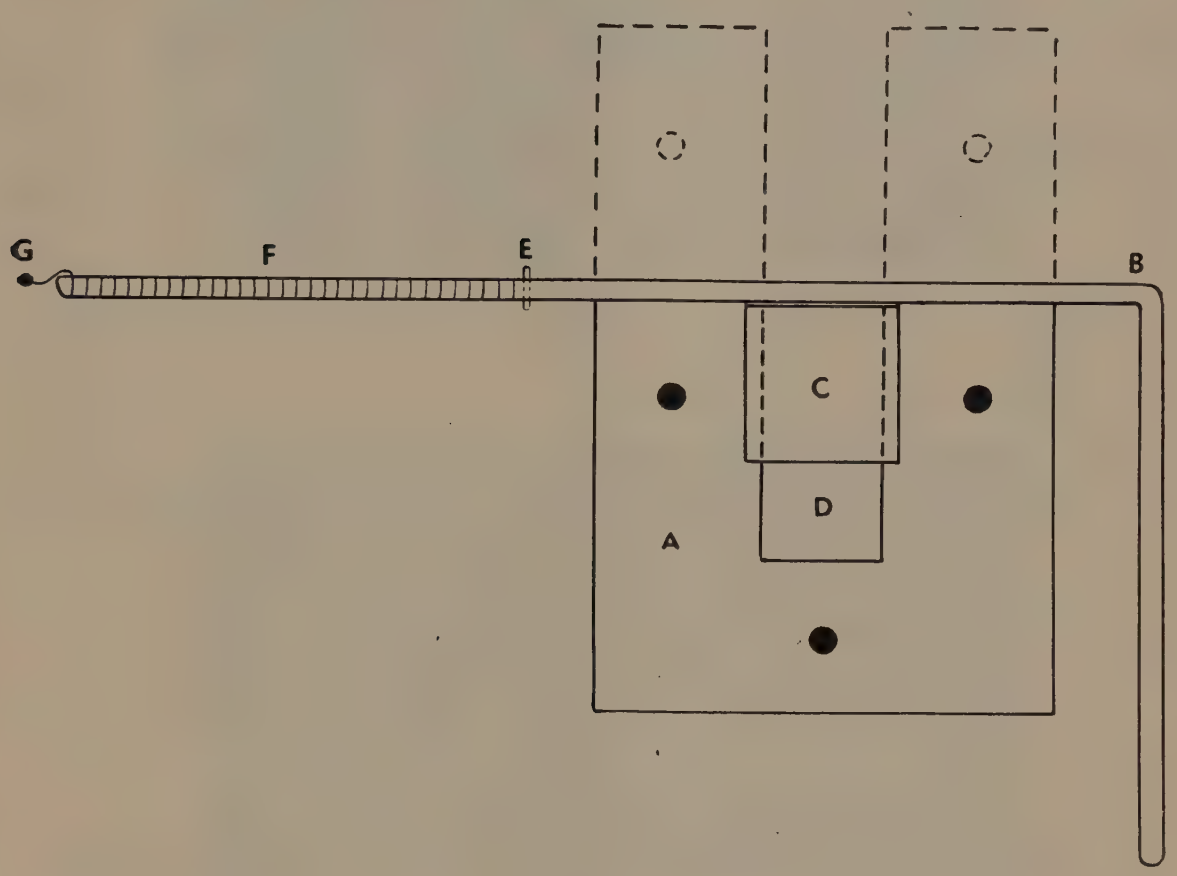


Plate 7.

Trigger Release Mechanism. A. Metal plate bolted to cross-piece. The dotted portions at the top are bent back over the rod B. B. Metal rod ($\frac{1}{2}$"). C. Spring steel pawl welded to metal rod. D. Keyway. E. Pin through rod. F. Steel spring. G. Pin to cross-piece.

The pawl itself is a piece of spring steel measuring 1 in. x 1 in. x $\frac{1}{4}$ in. and is welded to the metal rod, forming, together with a strong spring, the trigger release mechanism (Plate 7). The trigger release can be activated by the index finger, allowing both hands to be used on the top frame when releasing the branded calf. The 18-gauge steel spring has a fairly high tension and measures 3 in. in length and $\frac{1}{2}$ in. in diameter.

The metal cut from the plates to make the keyway for the ratchet was not completely removed but was bent into and used to line the keyway in the cross-piece, to prevent wear of the timber by the moving ratchet. The ratchet swings on a metal D of $\frac{1}{2}$-in. rod.

The bed-log, 6 in. x 6 in., is morticed to its full width into two round anchor posts which are buried 3 feet into the ground (Plate 8). Two strong steel pins (in the model described, sections of an old sulky axle were used) pass through the bed-log and are bent on themselves at the top to form a bolt hole with a neat $\frac{3}{4}$ in. clearance. The spacing of these pins is the same as that between the "hooks" of the frame.

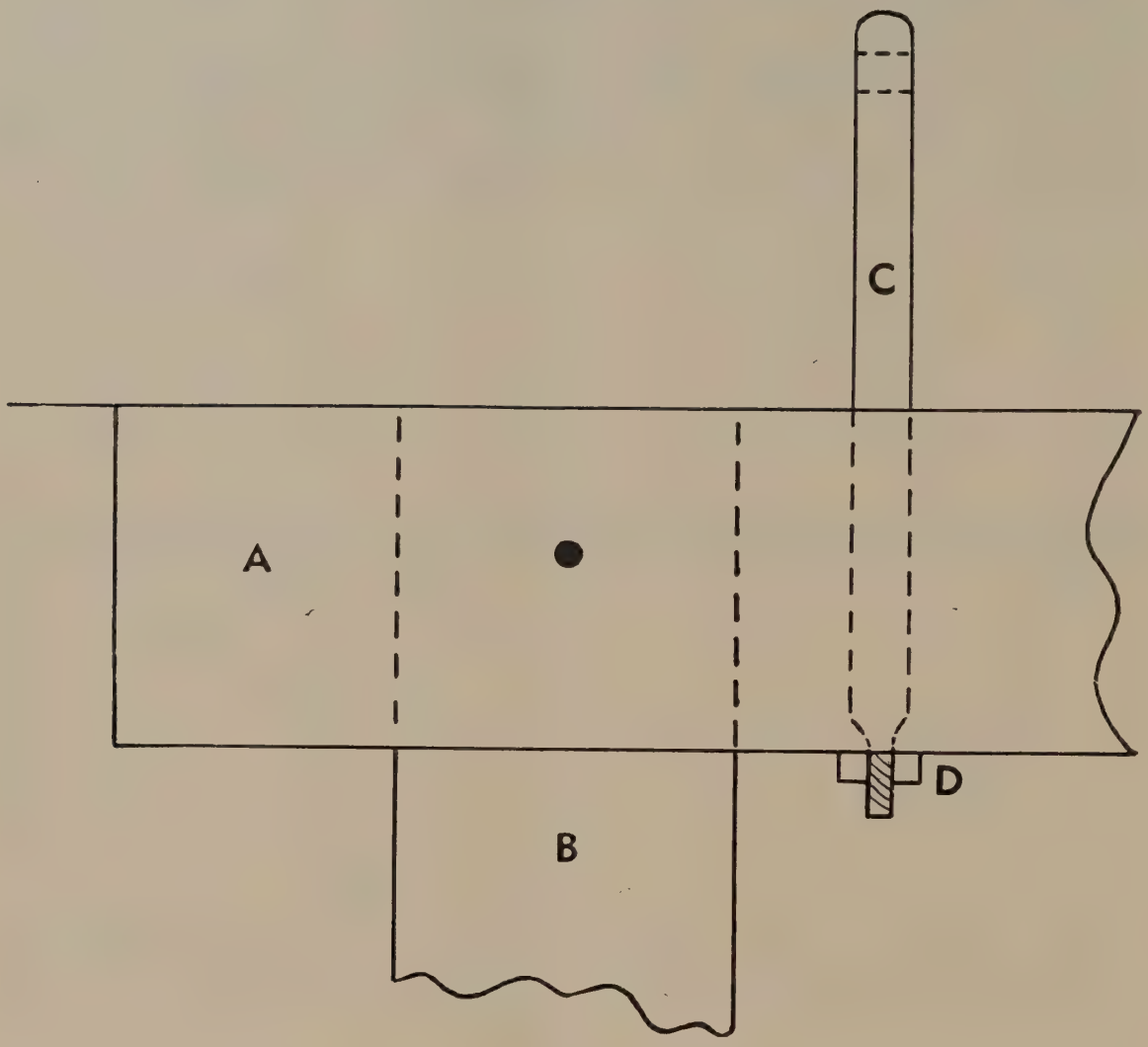


Plate 8.

Portion of Bed-log, Showing Means of Attaching Cradle. A. Bed-log 6" × 6" morticed into anchor post. B. Anchor post of round timber 3 ft. in ground. C. Steel pin 1" × 1" bent at top to form a $\frac{3}{4}$" bolt hole. D. Lock nut.

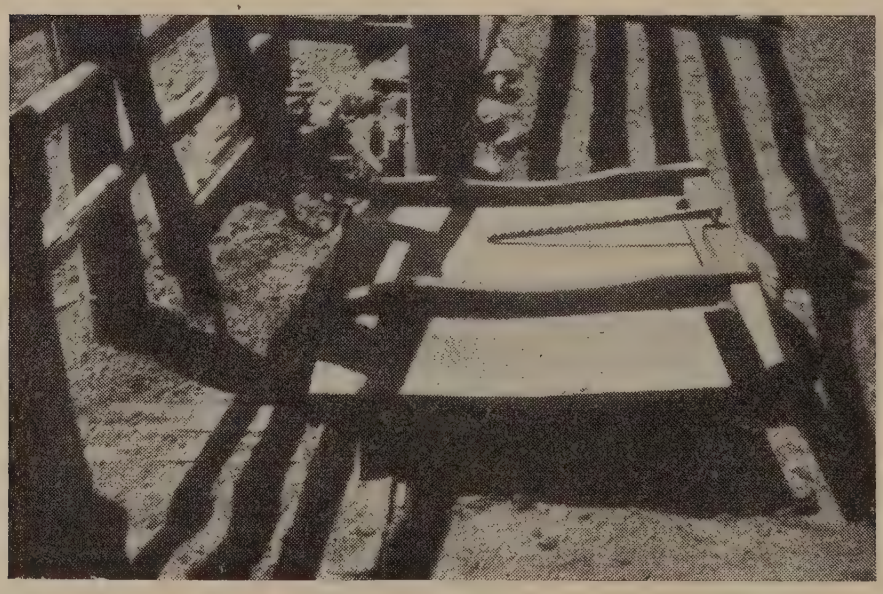


Plate 9.

Cradle Opened and Showing the Construction of the Lower Portion.



Plate 10.

Cradle Closed on Calf.



Plate 11.

Branding a Calf. The leg is chained to prevent struggling.



Plate 12.

Calf Branded and Ready to be Released.

The height of the pins above ground level is such that, when assembled, the rear "hook" just touches the ground, whilst the front "hook" clears the ground by several inches. In this case, a pin height of 7 in. was needed to achieve this clearance.

A counter-weight attached to the cradle by means of a rope passing over a pulley set in a high post makes for ease of operation, and the use of old tyres to give a cushion effect will prolong the life of the cradle.

The position of the calf in Plates 10-12 indicates the ease and efficiency with which the operations of castration and branding may be carried out in a suitable cradle. The cradle shown in these illustrations differs in detail of construction but not in principle from that illustrated in Plates 3-9.



Plate 13.

A Branding Cradle in Which the Calf is Held 18 Inches Clear of the Ground. Some cattlemen consider that this makes the work easier and reduces the risk of infection from dust and dirt.

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Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 28th FEBRUARY, 1953.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, via Pittsworth
	F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Hillcrest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
	O. H. Horton, Mannuem, Kingaroy
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, Box 22, Maleny
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Sherman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochdale
	H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, " Cedar Glen," Yarraman
	J. B. Dunlop, Acacia road, Kuraby
	A. Curd, Box 35, Jandowae
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek

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ASTRONOMICAL DATA FOR QUEENSLAND.

MAY

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	12	46	Longreach	28	42
6	6.16	5.13	Charleville	25	29	Quilpie	37	33
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	31	27	Roma	15	19
21	6.24	5.04	Dirranbandi ..	22	16	Townsville	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
31	6.29	5.00	Hughenden ..	23	47	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	6.29	7.59
2	7.23	8.58
3	8.21	9.56
4	9.24	10.48
5	10.29	11.36
		p.m.
6	11.34	12.19
7	..	12.58
	a.m.	
8	12.38	1.34
9	1.42	2.09
10	2.47	2.45
11	3.52	3.23
12	4.59	4.04
13	6.06	4.51
14	7.13	5.43
15	8.17	6.39
16	9.14	7.38
17	10.05	8.38
18	10.49	9.37
19	11.26	10.33
20	11.59	11.27
	p.m.	
21	12.29	..
		a.m.
22	12.58	12.20
23	1.26	1.11
24	1.55	2.03
25	2.25	2.56
26	2.59	3.51
27	3.38	4.48
28	4.23	5.48
29	5.15	6.49
30	6.13	7.48
31	7.16	8.43

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	30	10	45	25	20	0	53	28
6	25	13	41	28	16	3	47	31
11	15	24	30	40	6	16	35	47
16	10	30	25	44	0	20	27	53
21	16	21	31	38	7	12	36	43
26	26	13	42	29	17	3	49	32
31	29	10	45	25	20	0	52	28

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	54	5	67	34	51	20	44	6
3	54	3	67	32	51	18	44	4
5	56	8	68	36	52	21	46	8
7	43	18	59	43	44	27	36	17
9	31	30	51	50	35	35	25	25
11	20	41	43	58	28	44	17	35
13	9	50	37	63	21	49	8	42
15	3	55	34	67	18	52	4	45
17	6	51	35	64	20	50	6	43
19	13	43	39	59	24	45	12	36
21	22	34	45	54	30	39	19	29
23	32	29	52	50	36	35	26	25
25	41	19	57	43	42	28	34	17
27	50	6	64	34	48	20	41	7
29	54	4	67	33	51	19	44	5
31	53	4	67	33	50	19	44	5

Phases of the Moon.—Last Quarter, May 6, 10.21 p.m.; New Moon, May 13, 3.06 p.m.; First Quarter, May 21, 4.20 a.m.; Full Moon, May 29, 3.03 a.m.

On May 15 the sun will rise and set about 20 degrees north of true east and true west respectively.

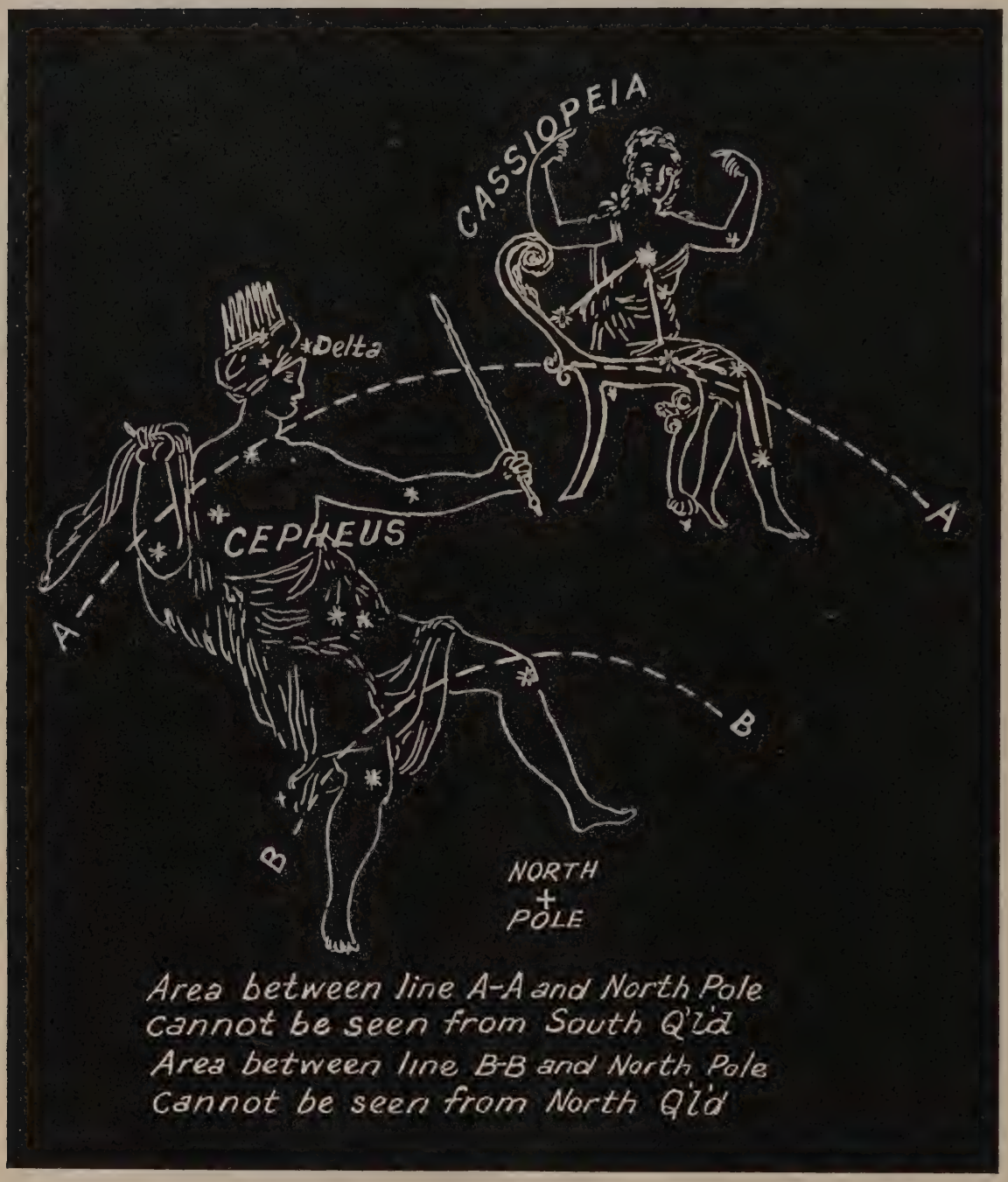
Mercury.—At the beginning of the month, in the constellation of Pisces, will rise 1 hour 44 minutes before the sun and will be in line with the sun on 24th, after which it will pass into the evening sky, and at the end of the month in the constellation of Taurus, will set 28 minutes after the sun.

Venus.—In the constellation of Pisces, at the beginning of the month will rise 1 hour 47 minutes before the sun and will reach greatest brilliancy on the 19th. By the end of the month it will rise 3 hours 20 minutes before the sun.

Mars.—Too close in line with the sun for observation.

Jupiter.—Also too close in line with the sun for observation.

Saturn.—In the constellation of Virgo, will rise just before sunset at the beginning of the month. On the 24th it will be about 5 degrees from Spica and on the 25th the moon will be near the planet. By the end of May it will set between 2.50 a.m. and 4.00 a.m.



THE CONSTELLATIONS.

Cassiopeia.

Though from southern Queensland it is not difficult to observe Cassiopeia, from North Queensland this constellation may be seen from 15 to 20 degrees above the northern horizon on the meridian. The constellation is well known in the northern hemisphere and is referred to as the "M" or "W" because of the shape of the brightest stars of the group. According to Greek legend, Cepheus and Cassiopeia were King and Queen of Ethiopia. The constellation contains many doubles, nebulae and clusters, and also the famous nova discovered by Tycho Brahe in 1572, the brightest nova recorded. When first observed by Tycho on November 11, 1572, it was brighter than Jupiter and Venus and at its brightest could be seen in broad daylight. At the end of the month it faded, gradually changing in colour from white to yellow ruddy, and finally by March, 1574, it had faded from view. Though Tycho fixed the position of this nova in relation to the surrounding stars as well as he could with the means then available, the star cannot now be located even with the most powerful telescopes. Cassiopeia is on the opposite side of the North Pole to Ursa Major and is best seen from Queensland in the evening during November and in the early morning during July.

Cepheus.

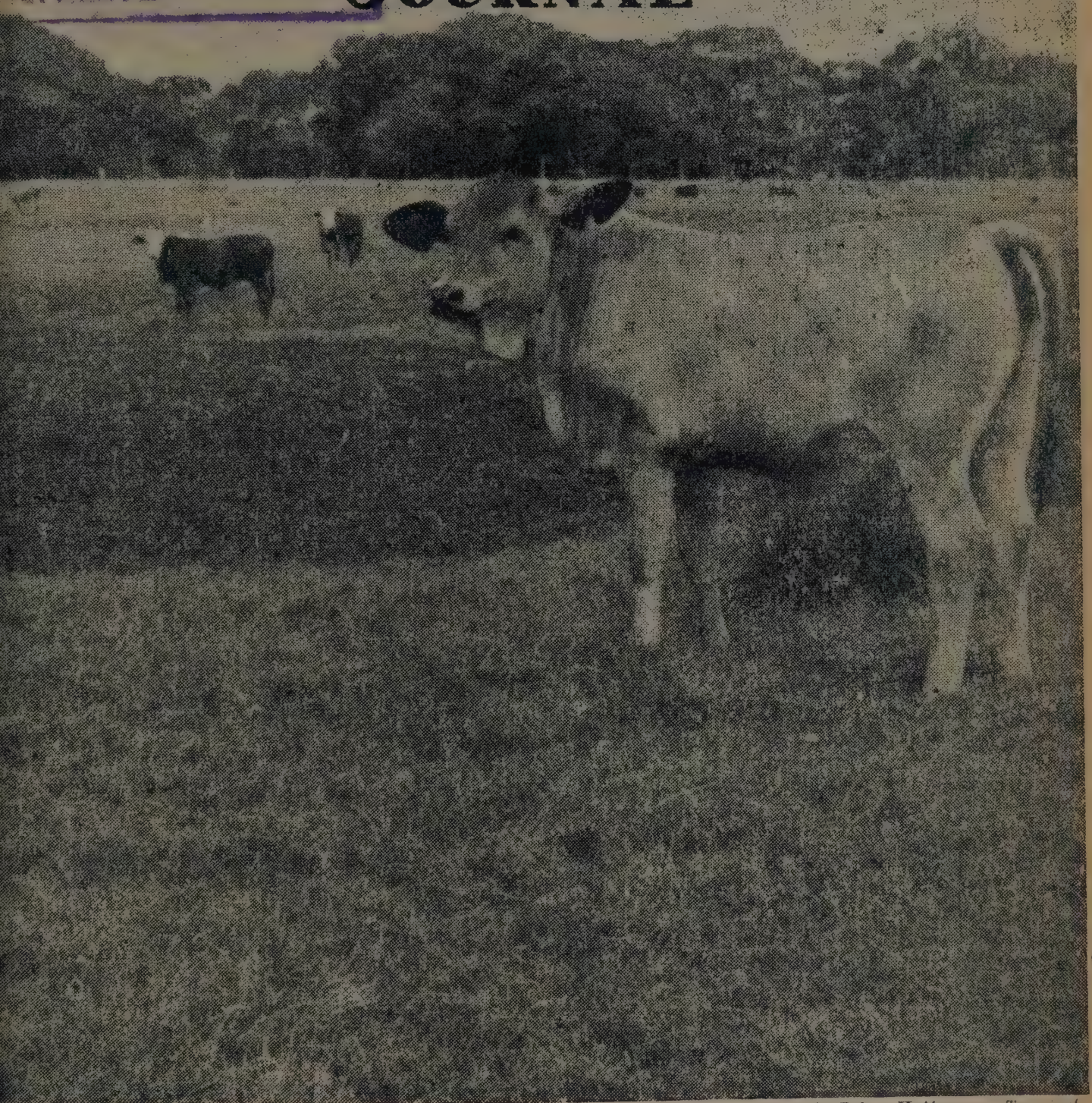
This group adjoins Cassiopeia but is closer to the North Pole, only the extreme southern tip being visible low on the horizon from North Queensland. This constellation also contains a number of double stars, variables and clusters. Delta Cephei is important as a typical star of the regular short-period variables. It was detected by John Goodricke in 1784. Its magnitude varies from a minimum of about 4.3 to a maximum of about 3.6 in one and a-half days, the decline, however, taking about 4 days. A cluster type Cepherd variable has a still shorter period—less than 24 hours. The study of Cepherd variables is of great importance in the determination of a star's distance, the distance having a definite relation to the period and magnitude.

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QUEENSLAND AGRICULTURAL JOURNAL



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Some Agricultural Features of the Central Highlands Region of Queensland.

P. J. SKERMAN, Agricultural Resources Officer, Bureau of Investigation, Department of Public Lands.

(*Continued from page* 149 *of the March issue.*)

Frost and Sorghum Growing.

In a study of frost in the Australian region, J. C. Foley, of the Commonwealth Meteorological Bureau, has presented data for light and heavy frosts at Clermont, Emerald and Springsure. He took a screen temperature of 36° F. to indicate a light frost at ground level, and 32° F. a heavy frost on the ground and frost extending above the ground to the level of foliage, blossom or setting fruit (four feet or so).

Referring to the Central Highlands area, Foley wrote: "Few heavy frosts are recorded in this region except in the Mackenzie River Valley (Emerald and Springsure), where the average first and last dates of screen temperatures of 32° or under are 5th-7th July and 24th-28th July. Screen temperatures of 36° or under may occur, however, from the end of April in the Springsure-Clermont area (average 16th to 23rd June) . . ."

The data in Tables 8 and 9, taken from Foley's lists, provide information on frost occurrence in the Central Highlands.

TABLE 8.

First and Last Severe Frosts of the Season (32° Screen).

Station.	Years of Records from—	First 32° 1930–39.	First 32° since First Records Kept.	Last 32° 1930–39.	Last 32° since Records Kept.
Clermont	1911	July 14	May 15	July 27	Aug. 25
Emerald	1908	July 5	May 26	July 24	Aug. 25
Springsure	1913	July 7	April 27	July 28	Aug. 25

TABLE 9.

AVERAGE NUMBER OF DAYS PER MONTH OF MINIMUM SCREEN TEMPERATURES OF 32° F. OR UNDER (1930–1939).

Station.	April.	May.	June.	July.	Aug.	Sept.	Year.
Clermont	..	..	2·2	3·0	1·9	..	7·1
Emerald	..	..	2·6	2·8	2·5	..	7·9
Springsure ..	..	0·2	4·1	3·0	4·0	0·4	11·7

Elaborating on the low temperature factor, workers in the Department of Agriculture and Stock in 1948 prepared the information shown in Table 10.

TABLE 10.

DATA ON FROST OCCURRENCE.

Station.	Mean Annual Rainfall.	Mean Minimum Temperature for Coldest Month.	Average Date of First Occurrence of Screen Temperature of 36 °F.	Mean Deviation from Average. (days).	First Recorded Date of Occurrence of Screen Temperature of 36 °F. since 1938.	Average Frost-free Period (36 °F.) in Days.
	In.	°F				
Clermont ..	26·97	42·7	June 21	10	April 28	319
Emerald.. ..	24·61	44·2 } July	June 23	15	April 28	311
Springsure ..	26·19	43·0	June 16	11	April 22	299
Dalby	26·12	40·1	May 18	18	April 17	246
Miles	25·63	38·4	May 19	17	April 17	238
Pittsworth ..	27·22	41·3 } July	May 27	21	April 17	267
Goondiwindi ..	24·05	41·3	May 31	12	April 17	274
Warwick ..	27·49	37·8	May 12	18	April 10	233

The workers concerned stated: "It will be seen that in the Clermont-Emerald-Springsure area the first frost is later than in the Darling Downs region and there is a longer frost-free period. The later onset of frost in the more northerly region gives a growing period for summer crops about 30 days longer than in the Darling Downs. This longer growing period may allow of later planting, so that advantage may be taken of the late summer rains which are more reliable than those of October, November and December."

TABLE 11.

CHANCE (AS A PERCENTAGE OF YEARS) OF RECORDING SCREEN TEMPERATURES BELOW 36° F. and 32° F. at CLERMONT.

Date.	Chance.	
	36 °F. or Less.	32 °F. or Less.
Before—	%	%
April 7	Nil	Nil
April 14	Nil	Nil
April 21	Nil	Nil
April 30	3	Nil
May 7	3	Nil
May 14	16	3
May 21	24	3
May 31	33	8
June 7	50	20
June 14	66	25
June 21	75	33
June 30	75	50

A study of the incidence of screen temperatures of 36° F. or lower and 32° F. or lower for Clermont since 1938 reveals that the chances of receiving recordings within various ranges are as given in Table 11.

Sorghum Planting Time in Relation to Frosts.

From field observations at Peak Downs made by M. Davis (Agricultural Assistant, Queensland-British Food Corporation), the collation of data for the main sorghum varieties in use shown in Table 12 has been made.

TABLE 12.

Developmental Periods of Sorghum Varieties.

Variety.	Days from Planting to Flowering.	Days from Planting to Maturity of Primary Head.	Days to General Harvest.
Early Kalo	54	110	129
Wheatland	63	117	133
Caprock	63	117	133
Kalo	62	117	129
Martin	60	117	129
Plainsman	63	117	129
Hegari	59	110	129

The variety Kalo has been planted on large acreages, and adopting this variety for discussion, a growth chart can be drawn up as shown in Table 13.

TABLE 13.

Theoretical Development of Kalo Grain Sorghum Planted at Various Dates.

Planting Week.	1st Flowering.	1st Head Mature.	General Harvest.
Oct. 1– 8	Dec. 2– 9	Jan. 27– 3 Feb.	Feb. 8–15
9–15	10–17	Feb. 4–11	16–23
16–23	18–25	12–19	24– 3 Mar.
24–31	26– 3 Jan.	20–27	Mar. 4–11
Nov. 1– 8	Jan. 3–10	28– 7 Mar.	12–19
9–16	11–18	Mar. 8–15	20–27
17–24	19–26	16–23	28– 4 Apr.
25– 2 Dec.	27– 3 Feb.	24–31	Apr. 5–12
Dec. 3–10	Feb. 4–11	Apr. 1– 8	13–20
11–18	12–19	9–16	21–28
19–26	20–27	17–24	29– 6 May
27– 3 Jan.	28– 4 Mar.	25– 2 May	May 7–14
Jan. 4–11	Mar. 5–12	May 3–10	15–22
12–19	13–20	11–18	23–30
20–27	21–28	19–26	31– 7 June
28– 4 Feb.	29– 5 Apr.	27– 3 June	June 8–15
Feb. 5–12	Apr. 6–13	June 4–11	16–23
13–20	14–21	12–19	24– 1 July
21–28	22–29	20–27	July 2– 9
Mar. 1– 8	30– 7 May	28– 4 July	10–17
9–16	May 8–15	July 5–12	18–25
17–24	16–23	13–20	26– 2 Aug.

Early Kalo and Hegari ripen about a week earlier than Kalo, but the main varieties, such as Wheatland, Caprock and Martin, have a similar growing period to Kalo. It is also a fact that the same variety planted late in the season takes fewer days to mature than when planted early.

From limited observations in the Central Highlands, it would appear that the hard-dough stage is reached approximately one month before the general harvest. Frost damage after the hard-dough stage is reached would be relatively slight, whereas before that stage severe pinching of the grain would result.

From a perusal of Table 13, it appears that plantings made up to January 28 should generally be free from frost damage. Thereafter, the risks would be as set out in Table 14. Though damage after the hard-dough stage is reached would not be substantial, for safety's sake, damage is taken in Table 14 to be likely up to 14 days before general harvest.

TABLE 14.

FROST RISK AS RELATED TO PLANTING DATE.

Planting Date.	Flowering Date.	Frost Risk at Flowering.	Frost Risk for Grain (i.e., Frost Occurs before 14 Days from Full Maturity).	1st Head Maturity Date.
Jan. 28 to Feb. 4	Mar. 29 to Apr. 5	Nil	33% of years possibility of some pinched grain. *No frost for fourteen consecutive years* 1930–43	May 27 to June 3
Feb. 5–12	Apr. 6–13	Nil	50% of years risk of some pinched grain but incidence irregular (e.g., seven consecutive frost-free years)	June 4–11
Feb. 13–20	Apr. 14–21	Nil	67% of years risk of some pinching of the grain	June 12–19
Feb. 21–28	Apr. 22–29	1 in 38 years	75% of years risk of pinched grain or failure to set grain	June 20–27

NOTE.—Heavy frosts on May 8, 9, and 10, 1949, severely damaged the first crop grown by the Queensland–British Food Corporation. A frost as early as this had been recorded only once in the previous 36 years.



Plate 4.

The Black Earth of Peak Downs, Capella. Virgin land being brought under the plough for the first time.

The average frost-free period for the Central Highlands area is 310 days, just over twice the necessary frost-free period for the crop. Hence early and mid-season plantings would normally escape. However, it is in the years when no early planting rains occur that close consideration must be given to frost hazards and the risks involved.

Heat Waves and Sorghum Growing.

A characteristic of Queensland's sub-tropical and tropical agriculture is the occurrence of heat-wave periods during the summer months. The incidence and severity of these may vary and an analysis of actual heat-wave occurrences for Clermont, and comparisons with Biloela and Downs centres, are presented in Table 15. A "heat wave" on Plate 6 is indicated by a succession of days on which the maximum temperature exceeded 100°F. This is an empirical standard, as no actual correlations have been established, but it is near the mark. It is known that a succession of three days in which the maximum temperature exceeded 100°F. has adversely affected sorghum crops on the Regional Experiment Station at Biloela.



Plate 5.

A Crop of Wheatland Sorghum on Cullen-la-ringo.

The time of occurrence of the heat wave in relation to the stage of plant growth is important. A heat wave can be most destructive at the flowering period, as the heat may destroy the vitality of the pollen. It can also be very destructive within the first month of the growing period. An established crop can withstand hot weather fairly well if there is sufficient subsoil moisture from which the roots can draw their supply. Sorghum, by the aid of the waxy stem covering, curling of the leaves and relatively small number of leaf stomata, is better adapted to withstand drought conditions than most other agricultural crops.

The distribution of "heat waves" for Clermont, the Callide and Downs centres is given in Table 15. From a perusal of the heat-wave data as presented it can be seen that very early and very late plantings will generally miss the heat waves, whereas normal plantings always run some risk of heat-wave interference. Table 16 gives some idea of what might be expected.

TABLE 15.

HEAT WAVE DATA (NOVEMBER–MARCH), 1914–1950.

Heat Waves.	Clermont.					Dalby.					Warwick.					Pittsworth.				
	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.
2 consecutive days with maximum temperature over 100° F	31	45	57	19	10	6	8	18	6	3	1	7	8	1	..	1	1	5	2	..
3 ditto	16	30	41	14	7	3	3	9	1	2	1	1	6	1	..	1	1	3	..	..
5 ditto	6	8	14	1	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	6	9	5	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 consecutive days with maximum temperature 105° F or over	6	17	24	7	1	1	1	5	..	..	..	..	2	..	..	..	..	1	..	..
3 ditto	3	7	14	1	..	1	..	2	..	..	..	..	1	..	..	..	..	..	..	..
5 ditto	1	3	5	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

HEAT WAVE DATA, 1926–1950.

Heat Waves.	Clermont.					Biloela.					Dalby.					Warwick.					Pittsworth.				
	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.
2 consecutive days with maximum temperature over 100° F	22	31	43	13	8	..	6	14	3	..	3	5	14	2	1	1	5	8	..	..	1	..	4	..	..
3 ditto	11	20	32	9	5	..	3	9	1	..	1	1	8	1	..	1	..	6	..	..	1	..	2	..	..
5 ditto	3	11	15	2	..	..	..	4	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	4	11	2	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 consecutive days with maximum temperature 105° F or over	4	13	16	3	..	..	..	4	..	..	1	1	4	..	..	..	..	2	..	..	..	..	1	..	..
3 ditto	2	6	9	1	..	..	..	1	..	..	1	..	2	..	..	..	..	1	..	..	..	..	..	..	..
5 ditto	..	2	5	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7 ditto	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE 16.

Expectation of Heat Waves.

Planting Period.	Heat Waves of 3 Consecutive Days or More over 100 °F.		Heat Waves of 3 Consecutive Days or More over 105 °F.	
	Within One Month of Planting.	During Flowering Week.	Within One Month of Planting.	During Flowering Week.
	%	%	%	%
Oct. 1– 8	6	70	Nil	28
9–15	20	70	6	33
16–23	25	70	6	33
24–31	37	67	6	28
Nov. 1– 8	42	67	8	28
9–16	42	67	22	33
17–24	50	40	22	20
25– 2 Dec.	67	28	25	6
Dec. 3–10	70	28	28	3
11–18	70	28	33	3
19–26	70	28	33	Nil
27– 3 Jan.	67	22	28	Nil
Jan. 4–11	67	14	28	Nil
12–19	67	3	33	Nil
20–27	40	3	20	Nil
28– 4 Feb.	28	Nil	6	Nil
Feb. 5–12	28	Nil	3	Nil
13–20	28	Nil	3	Nil
21–28	22	Nil	Nil	Nil
Mar. 1– 8	14	Nil	Nil	Nil
9–16	3	Nil	Nil	Nil
17–24	3	Nil	Nil	Nil

A study of these figures will show that October plantings miss the early heat waves but generally experience rather severe heat waves during the flowering period. November plantings experience about even chances of heat waves on young plants and about a 1 in 4 to 5 chance of experiencing heat waves during flowering. December plantings generally have hot weather in the early growth, with much risk of severe heat waves at flowering. January plantings have slightly more risk of early heat waves and much less risk at flowering. Late January and February plantings have still less chance of experiencing early heat waves and little chance of heat waves at flowering. However, these late plantings must be considered in relation to frost risks, as set out in the frost-risk table.

Sorghum Midge.

Sorghum midge attacks the developing grain shortly after fertilisation and in severe attacks may completely ruin the field for grain purposes. It is subject to some climatic control, being dormant during the cool weather. In spring the numbers of adults emerging are relatively few and so the early-sown crops escape serious midge damage. A succession of generations occur at fortnightly intervals, building up the population as the season progresses and temperature and moisture conditions become more suitable. Activity ceases as the cooler weather approaches and crops sown very late also escape damage. Under these conditions the mid-season and late crops may experience very heavy midge attack.

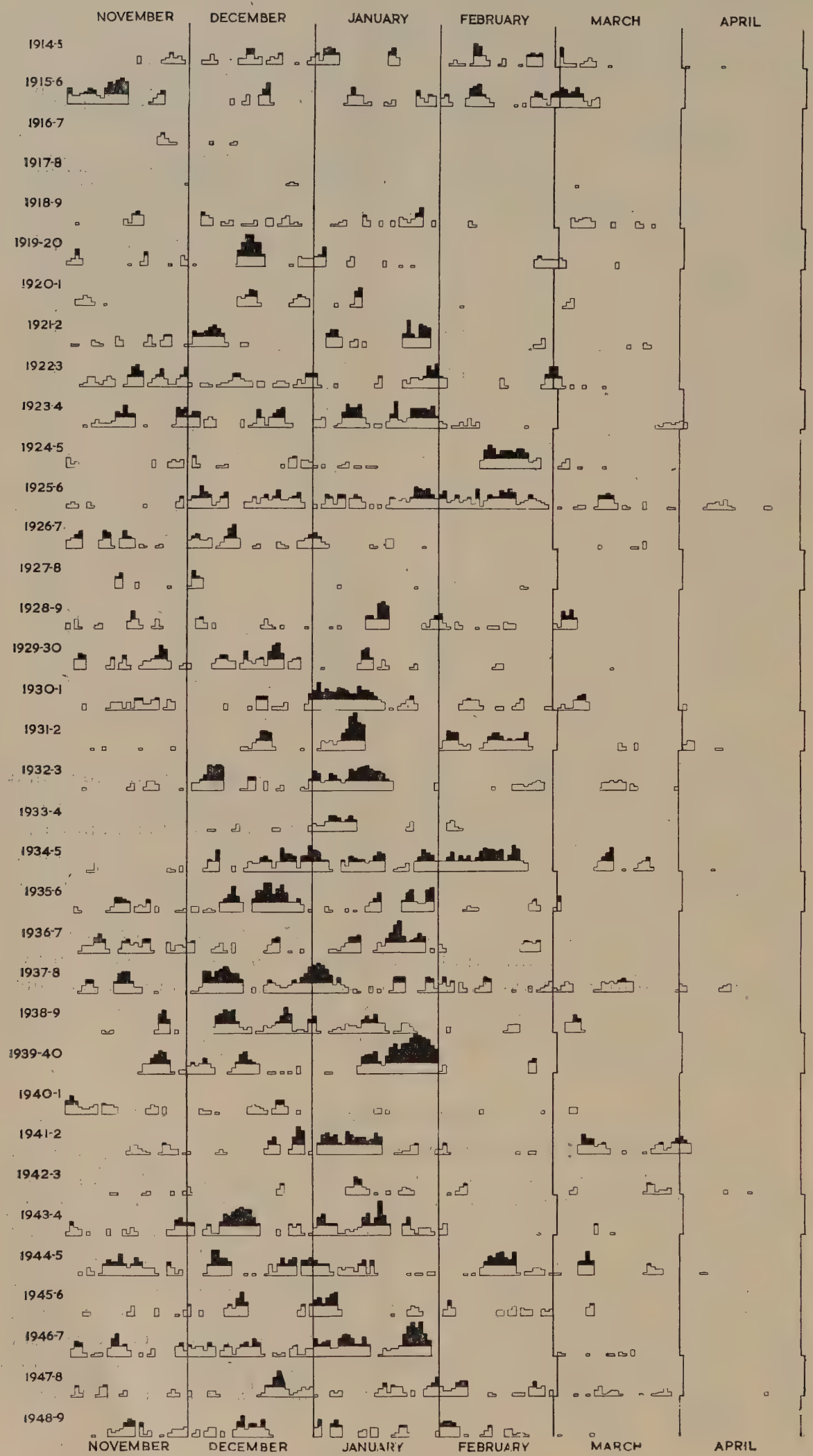

NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
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1946-7
1947-8
1948-9
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL

Plate 6.

The Central Highlands were relatively free from midge damage during the first two crops grown by the Queensland-British Food Corporation, but subsequently midge damage has been quite a factor in depressing yields in certain fields.

One control measure is to stagger plantings so that the crop misses the main population waves. However, on the large properties, with so much sorghum regrowth and volunteer growth from spilled grain on roadways, railway sidings, etc., it is very difficult in practice to avoid midge infestation by planting-date control in the main growing season. Air-dusting or spraying for midge control is being introduced into the sorghum-growing areas, using DDT dust or spray. The cost of the spraying operation must be set out against probable increased yields to determine the economics of treatment. Costs are frequently changing but are of the order of 25s. per acre (1951) and the increased yield because of dusting would depend on the severity of the midge attack, usually a 60% save (that is, an estimated crop of 30 bushels might yield 12 bushels under midge attack and 24 bushels as the result of spraying).

Summary of Risks.

Having considered the meteorological (including sorghum midge) risks individually, a general table of risks in relation to planting has been drawn up (Table 17).

No account has been taken of risk of drought during the fallowing or growing period. It will be seen that the planting rain constitutes the greatest risk and that opportunity should be taken to make use of each planting rain which falls. Plantings made in the first three weeks in October, however, run a big risk of flowering in the main heat-wave period, while those made in the first three weeks in December experience the heat in their very young stages. February plantings run a risk of early frosts. Early plantings have an advantage in that if some setback occurs the crop can be fed off or ploughed in and a replant made later. Consequently it would appear that plantings should be staggered and sowings made after good falls of rain from the third week in October until mid-February at the latest.

EXPERIMENTAL SORGHUM PLANTINGS, PEAK DOWNS, 1950.

The following experimental results were obtained on the black soil experimental area at Peak Downs during the very good rainfall year of 1950 on land prepared by one sundercutting and two cultivations with the combine. It will be seen that under the good rainfall conditions practically a straight-line increase in yields accompanied each heavier planting, and if a preliminary subsoil moisture survey revealed good moisture, heavier plantings should pay handsomely in these good years.

EXPLANATION OF PLATE 6.

Diagram Showing the Occurrence of Heat Waves at Clermont from 1919 to 1949. The temperature baseline in each year is 95°F. and temperatures exceeding 100°F. are blacked in. This diagram is a reduced copy of one which appeared in the Report of the Bureau of Investigation for 1949.

TABLE 17.

SORGHUM PLANTING RISKS, CLERMONT, 1914–1949.

Percentage of years in which there are risks in relation to planting date.

Proposed Planting Week.	Insufficient Planting Rain (less than 150 Points).	Early Heat Wave.		Heat Wave at Flowering.		Frost (up to 14 Days before General Harvest).		Midge Damage.
		Medium Intensity.	Severe.	Medium.	Severe.	36 °F.	32 °F.	
	%	%	%	%	%	%	%	
Oct. 1– 8	97	6	Nil	72	29	Nil	Nil	
9–16	97	20	6	73	33	Nil	Nil	
17–24	97	25	6	73	33	Nil	Nil	
25–31	91	37	6	67	29	Nil	Nil	Slight to Nil
Nov. 1– 8	94	43	8	67	29	Nil	Nil	
9–16	80	43	22	67	33	Nil	Nil	
17–24	91	50	22	40	20	Nil	Nil	
25– 2 Dec.	91	67	25	29	6	Nil	Nil	
Dec. 3–10	80	72	29	29	3	Nil	Nil	
11–18	74	73	33	29	3	Nil	Nil	
19–26	83	73	33	22	Nil	Nil	Nil	
27– 3 Jan.	77	67	29	14	Nil	3	Nil	Severe
Jan. 4–11	74	67	29	3	Nil	3	Nil	
12–19	80	67	33	3	Nil	17	3	
20–27	71	40	20	Nil	Nil	25	3	
28– 4 Feb.	74	29	6	Nil	Nil	33	8	
Feb. 5–12	69	29	3	Nil	Nil	50	20	
13–20	77	29	3	Nil	Nil	67	25	
21–28	83	22	Nil	Nil	Nil	75	33	
Mar. 1– 8	94	14	Nil	Nil	Nil	75	50	Slight to nil
9–16	77	3	Nil	Nil	Nil	80	55	
17–24	80	3	Nil	Nil	Nil	87	67	

Sorghum Variety Trial.

Eight varieties were tried here, each variety being represented four times in an 8 x 4 trial. The following average yields per acre were obtained. (The plots were sown in 14-inch rows at 7.7 lb. per acre; planted 26-1-50; harvested 16-6-50).

Variety.	Mean Yield. Bushels.	Significantly Better Than—
1. Hermitage Selection ..	66·72	4, 5, 6, 7, 8
2. Kalo	63·00	6, 7, 8
3. Caprock	62·05	6, 7, 8
4. Plainsman	61·18	6, 7, 8
5. Hegari..	61·00	6, 7, 8
6. Wheatland	52·42	8
7. Martin..	51·22	8
8. Early Kalo	33·28	..

Sorghum Rate-of-Planting Trial.

This trial consisted of five plots each of 9½ lb., 7.7 lb. and 5.6 lb. per acre in rows 14 inches apart, using Kalo. The yields were as follows:

Sowing Rate.	Mean Yield. Bushels.	Significantly Better Than—
1. 9·5 lb.	54·70	2, 3
2. 7·7 lb.	48·76	3
3. 5·6 lb.	35·16	..

Sorghum Rate-of-Planting and Spacing Trial.

This trial consisted of six plots of Kalo, each with the following combinations of row space and planting rate—

7 in. spacing; 10 lb. seed per acre.
14 in. spacing; 7.7 lb. seed per acre.
21 in. spacing; 5.1 lb. seed per acre.
28 in. spacing; 4.25 lb. seed per acre.
35 in. spacing; 3.8 lb. seed per acre.

The average per acre yields obtained were:—

Treatment.	Mean Yield. Bushels.	Significantly Better Than—
1. 7 in. x 10. lb. ..	51·37	2, 3, 4, 5
2. 14 in. x 7·7 lb. ..	43·07	3, 4, 5
3. 21 in. x 5·1 lb. ..	32·73	4, 5
4. 28 in. x 4.·25 lb. ..	29·32	5
5. 35 in. x 3·8 lb. ..	25·78	..

In order to check the results of the rate-of-planting trials, stand counts of the plots were made to ascertain how many plants per acre were harvested. It is emphasised that all reports submitted during the growth of the trial plots were to the effect that the strike was good and the plots were looking well. The stand counts obtained were as given in Table 18.

TABLE 18.

DATA FROM STAND COUNTS IN RATE-OF-PLANTING TRIALS.

Variety.	Laboratory Germination.	Plants Harvested per Acre.	Tillers Harvested per Acre.	No. of Seeds per Lb. (Approx.).	Effective Seed per Acre (Approx.).		Average Tillers per Plant.
					Plants.	Tillers.	
	%				Lb.	Lb.	
Early Kalo ..	Certified	21,978	45,732	23,200	1	2	2·08
Wheatland ..	70	27,195	53,835	16,880	1½	3½	1·94
Hermitage Selection ..	..	43,845	61,938	23,200	2	2¾	1·41
Caprock	75	30,414	39,627	16,880	1¾	2⅓	1·30
Kalo	74	36,075	54,279	23,200	1½	2⅓	1·57
Martin	81	26,751	36,186	16,000	1½	2¼	1·35
Plainsman ..	84	41,403	48,507	16,880	2½	2⅘	1·17
Hegari	81	24,864	56,388	16,880	1½	2⅓	2·27

It will thus be seen that for a planting rate of 7.7 lb. per acre only one-eighth to one-third survived as mature plants, bearing out experience on the heavy soils of the Darling Downs and in the United States.

Counts were also made in the row spacing trials, with the results as set out in Table 19.

TABLE 19.

DATA FROM STAND COUNTS IN ROW SPACING TRIALS.

Spacing and Rate.	No. of Plants per Acre.	No. of Tillers per Acre.	Effective Seed per Acre.		Average Tillers per Plant.
			Plants (Approx.).	Tillers (Approx.).	
			Lb.	Lb.	
7 inches x 10 lb. ..	43,829	54,612	2	2⅔	1·25
14 inches x 7·7 lb. ..	32,412	39,827	1½	1⅔	1·22
21 inches x 5·1 lb. ..	18,648	24,864	¾	1	1·33
28 inches x 4·25 lb. ..	14,341	20,291	⅔	1	1·41
35 inches x 3·8 lb. ..	10,789	14,519	½	⅔	1·34

The results indicate that over all of the trials the germination percentage as indicated by the plant stand at harvest was only 20%—that is, five times the amount of seed was planted for the strike obtained. This result was obtained under *good planting conditions* with *certified seed* under *standard trial conditions*. It is obvious then that a good deal of research is necessary in connection with germination of the seed in the field. With adequate preplanting subsoil moisture, a heavier planting rate is indicated.

In general, the rate of planting of sorghum varies with the expected conditions. That is, if there is sufficient subsoil moisture at planting time to ensure a good crop, the planting can be heavier than in the case of poor subsoil moisture. A moisture survey before planting would be worth while on large areas. Likely rainfall during the post-planting season cannot be predicted and one can only work on averages. Commercial growers in Queensland usually adopt a planting rate of 6-8 lb. of seed per acre with a row spacing of 14 inches, and the whole of the crop is handled with wheat-planting machinery.

The variability of the seed has an important effect on the ultimate stand and very mixed results have been obtained over the years in actual plant stands.

Following on experimental plantings at Peak Downs in the 1949-50 season, Hart in his experiments in 1950-51 at Springsure arrived at an optimum spacing with plants 12-15 in. apart in rows 14 in. apart. On the basis of a 25% field germination this is equivalent to 6½-8½ lb. per acre of Kalo for the Springsure properties, with a possible reduction to 4-6 lb. per acre for Peak Downs because of generally higher field germination.

Hart further showed that there was a significant difference in favour of rolling following planting to press the moist soil around the seed. This press-wheel practice is followed frequently on the Darling Downs and overseas.

A further consideration is one of policy—does it pay better to capitalise the good moisture conditions than to try to arrange an average planting rate year in year out? The former is considered to be a better approach, particularly when grain growing is combined with grazing, as in a good year there will be ample natural feed for the stock and the grain crop can be harvested and sold, whereas in a lean year the poor crop can be utilised for grazing.

The trials reported above were planted in the period January 19-24, 1950, after 176 points of rain on the 18th and a total of 70 points from the 1st to the 12th inclusive. A further 53 points fell on the 23rd. The plots were harvested about June 16, 1950, but any rain after May 16 would have been ineffective so far as yield is concerned.

The rainfall during the growing period was—

	Points.
January 24–31	108
February	585
March	482
April	503
May 1–16	..
	1,678

The rainfall for January-May (inclusive), 1950, compared with the Peak Downs average to 1947, is as follows:—

	1950. Points.	Average. Points.
January	407	440
February	585	325
March	482	260
April	503	125
May	215	95
	2,192	1,245

The experimental results are interesting in that they point to the productive capacity of the Central Highlands black soils under favourable conditions, and indicate problems such as poor germination which are likely to occur. For a closer picture of the problems involved and methods of overcoming them, experiments would have to be continued for a number of years.

THE FEEDING VALUE OF SORGHUM STUBBLE.

Grain sorghum stubble has been utilised for a number of years by dairy-farmers on the Darling Downs and in the Callide Valley to provide roughage and some nutrients during the winter months. The actual feeding value has not been ascertained experimentally.

The Queensland-British Food Corporation, since its inception, has successfully turned off fat bullocks grazed on the residues following the harvesting of the grain crop. Due to the vagaries of the weather, in most cases these residues have been enhanced in feeding value by the presence of second-growth grain, green shoots from the root crowns, and a very rich admixture of native legumes (for example, *Glycine tomentosa*) and native grasses such as Flinders, sago, blue and hoop Mitchell.



Plate 7.

Heavy Volunteer Growth of the Native Legume Glycine tomentosa in Ripening Sorghum, Peak Downs, 1950. This grazing mixture was used to fatten pigs while the legume was succulent.

In an attempt to ascertain the feeding value as indicated by chemical analyses, samples of sorghum "stubble" were collected from various properties in the 1949-50 and 1950-51 seasons and submitted to the Agricultural Chemist of the Department of Agriculture and Stock for analysis. The stalk, flag and threshed heads were analysed separately. The analyses, together with data for lucerne hay and Flinders grass hay from one of the paddocks, are shown in Table 20.

From the analyses it can be seen that considerable variation occurs. In the 1949-50 crop, the protein content of the flag was remarkably high, approximating that of lucerne hay. In the following season, however, the feeding value of the flag was considerably lower.

Field observations indicated that this crop suffered some nitrogen deficiency, due probably to the heavy leaching caused by the excessively wet period from October to January, in which 22·15 inches fell at Peak Downs, compared with 12·93 inches in the same period in 1949-50. There is evidence from the Callide Valley that the protein content of the flag depends a good deal on the nitrogen status of the soil, and this appears to hold also in the Central Highlands.

TABLE 20.

Analyses of "Stubble" from Grain Sorghum Paddocks.

Feed.	Moisture.	Water-free Material.						
		Crude Protein.	Crude Fat.	Crude Fibre.	Carbo-hydrates.	Ash.	P_2O_5.	CaO.
	%	%	%	%	%	%	%	%
Lucerne hay ..	10·0	15·0	2·0	28·9	36·6	8·2	..	..
1949–50 Crops.								
Hegari (flag) ..	10·4	8·6	1·6	23·7	40·8	25·3	0·31	1·07
Kalo (flag) ..	12·8	18·1	1·4	27·2	39·8	13·5	0·34	0·87
Early Kalo (flag)..	10·1	12·7	0·6	25·5	42·5	18·7	0·49	1·35
Wheatland (flag)..	10·9	9·1	0·5	22·1	46·1	22·2	0·28	1·07
Caprock (flag) ..	11·0	7·8	1·0	30·9	42·5	17·8	0·38	1·21
Martin (flag) ..	10·9	9·5	1·1	26·0	39·0	24·4	0·31	1·01
Plainsman (flag) ..	10·6	8·3	1·2	29·6	39·1	21·8	0·35	1·07
Wheatland (threshed heads)	12·5	5·0	0·9	39·9	43·5	10·7	0·22	0·26
Wheatland (threshed heads)	12·2	5·9	1·3	37·9	43·1	11·8	0·26	0·71
1950–51 Crops.								
Kalo (stalks) ..	6·3	1·7	..	32·6	..	..	0·28	0·70
Kalo (flag) ..	6·3	2·9	..	27·6	..	..	1·01	0·58
Flinders grass hay	5·6	3·0	..	35·4	..	..	0·36	0·37

With the fertile soils of the Central Highlands, it is almost certain that herbage and grass growth, coupled with sorghum regrowth and residues, will always provide good feed for stock fattening.

ACKNOWLEDGMENTS.

The soil and plant analyses recorded in this article were made in the Chemical Laboratory of the Department of Agriculture and Stock, and the Department's Biometrician in the Division of Plant Industry assisted with interpretation of the experimental data. The Deputy Chairman and staff of the Queensland-British Food Corporation provided information, facilities and materials.

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Propagation of Fruit Trees.

By Officers of the Horticulture Branch.

THE majority of fruit trees are vegetatively propagated and consist of two parts, the stock and scion. The stock provides the root system and is chosen for its inherent vigour, its suitability for the soil type and its compatibility with the scion. The scion forms the head of the tree and therefore determines the type of fruit produced. As an orchard does not come into production for several years, well-worked trees with the right stock and scion characteristics are essential in commercial practice.

RAISING THE ROOTSTOCK TREE.

The majority of rootstocks are raised from seed but some can be propagated by cuttings or layers. The seed should be obtained from the mature fruit of disease-free trees with the required characteristics. Some types of seed are stratified in autumn and planted in spring. Others, such as citrus, are generally planted soon after they are extracted.

Fresh seeds of many deciduous fruits remain dormant for some time after they are removed from the fruit. The resting period of these seeds may be broken by low winter temperatures or alternatively by cold storage for periods ranging from one to three months. Usually the seed is stratified between layers of moist sand or peat moss and held in a cool place. Stratified seeds are normally planted early in spring before germination commences. Large seeds may, however, be examined at regular intervals during the stratification period, so that those which are ready to strike immediately can be planted at the one time.

Seed-beds.

A well-drained light sandy loam is required for the seed-bed to promote deep root growth. Such a soil is naturally infertile, and it is usual to add well-rotted compost, leaf mould or manure some weeks before the seed is planted. Facilities for overhead watering and shading are essential, as for some weeks after germination the young plants can tolerate neither lack of water nor exposure to the hot sun.

The normal seed-bed is 4 ft. wide and any convenient length, and it may be constructed with 8 in. x 1 in. hardwood frames raised about 4 in. above ground level. The soil is dug some weeks before the scheduled planting date, and subsequently brought to a fine tilth. The seed is usually sown in rows 4-6 in. apart, the depth and the rate of

sowing varying with the specific requirements of the plant. After sowing, the bed is smoothed and lightly tamped. Regular watering is then required until germination takes place.

Nursery Rows.

When the seedlings are 6-18 in. tall (again depending on the species), they are transferred to nursery rows (Plate 1) on land which has been cultivated deeply, the plant rows being opened up at $3\frac{1}{2}$ ft. spacings to a depth of about 6 in.



Plate 1.

Nursery Rows of Citrus. Seedlings are transplanted from the seed-bed to nursery rows when they are about nine inches tall.

After first thoroughly soaking the seed-bed, the young trees are lifted. Any misshapen or backward trees are discarded at this stage. After shortening the tap roots, the sound trees are set out 12 in. apart in nursery rows at the same depth as they were in the seed-bed. At this stage great care must be exercised in the placement of roots during transplanting; otherwise the trees may develop twisted and malformed roots. The nursery rows should be watered heavily after the trees are planted.



Plate 2.

Worked Citrus Trees in Nursery Rows.

When growth in the nursery rows is well forward, and the seedlings are large enough for "working," the trees are usually budded or grafted (that is, a scion of the required variety or strain is worked onto each stock). Only healthy, vigorous trees should be budded or grafted (Plate 2).

PRINCIPLES OF BUDDING AND GRAFTING.

Success in budding and grafting depends on accurate matching of, and close contact between, the growing tissues of the stock and scion. These tissues are known as the cambium tissues and lie between the bark and the wood. When a graft is made, callus tissue is formed in the region of the graft and the adjacent cells of the stock and scion interlock with each other to form a strong union.

Close contact between the cambium tissues of the stock and scion is only one factor in successful budding and grafting. Equally important are compatibility between the stock and scion varieties, careful handling of the wood to prevent drying-out, correct timing of the operation, efficient after-care of the graft and good workmanship.

Selection of Budwood and Graftwood.

Scions are selected from mature wood bearing strong, healthy buds. In most fruit trees, scion-wood is taken from the previous season's growth, but in the fig, 2-year-old wood is preferred. In subtropical fruits such as citrus and the avocado, mature wood from a recent flush of growth may be used. Scions or buds from the central portion of a bud-stick give the best results.

The trees from which budwood or graftwood is cut should be healthy, vigorous and free from virus diseases which are transmissable through the bud or graft. They must also be true to type and have a good cropping record.

In certain hardwood species, such as Macadamia nut, the branches of the trees are girdled some weeks before the scion-wood is cut to allow the accumulation of food reserves in the tissues.

Time of Budding and Grafting.

In many grafts, a scion has to be inserted under the bark of the stock and the work is usually carried out during periods of sap flow when the bark lifts freely. Normally, budding and grafting are performed in early spring, although in citrus and some other subtropical fruits the work can also be carried out in autumn.

After-Care of Grafts.

After-care of the graft is just as important as the budding or grafting operation itself. Most grafts are tied, preferably with damp raffia, and waxed or otherwise protected to prevent drying-out of the tissues and to exclude air and moisture from the union until the stock and scion have grown together. Commercial grafting waxes are available for protecting the union, but a home-made preparation containing 1 lb. beeswax, 1 lb. resin and $\frac{1}{2}$ lb. mutton fat or 1 lb. tallow is quite satisfactory. Such materials may be used alone or on waxed cloth.

The tie must be cut when the tissues of the stock and scion have knitted together, usually 2-3 weeks after grafting. The cut is made on that side of the stock opposite to the graft in order to avoid possible injury at the union.

In autumn-budded and autumn-grafted nursery trees, the stocks are shortened back early in the following spring to force the growth of the buds. With spring- or late-winter-worked trees, cutting-back may not

be necessary until the bud or graft has made some growth. In either case the stock is headed back just above the bud or graft with a sloping cut. Sometimes the stock trees are broken and bent over about 6 in. above the union to force the bud or graft into activity; the stock is then cut back when the scion is sufficiently large for staking.

A wire or wooden stake is frequently driven into the ground close to the stock of each worked tree and the shoot is tied to it with tape, raffia or string. Even in topworked trees, the grafts may require some support from stakes, which are lashed to the stock or driven into the ground.



Plate 3.
Young Citrus Tree Planted in the Orchard. The fork is about 18 inches above ground level.

Any shoots thrown by the stock after grafting or budding must be rubbed off as they appear. Similarly, side shoots developing on the scion must be suppressed until the terminal reaches the required head height for the tree. One or two lateral shoots may then be allowed to grow and form the framework of the future tree. The height for topping varies from 18 to 24 in. (Plate 3.)

Equipment.

The range of tools needed by the propagator depends on the method of budding or grafting to be used. They include budding and grafting knives (several types are available), secateurs, pruning saws, hammer chisels and, in the case of cleft grafts, a splitting tool. All tools should be of the best quality available and in first-class condition.

BUDDING.

Budding is generally used in nurseries for the propagation of young trees and also in the orchard to work one variety over to another. The work is carried out in autumn or spring, and occasionally in the late summer. There are several recognised methods of cutting the bud and inserting it on the stock plant. The best known and most widely practised is shield budding.

Shield Budding.

Shield budding (Plate 4a) is commonly used in nursery practice for many deciduous and subtropical fruits.

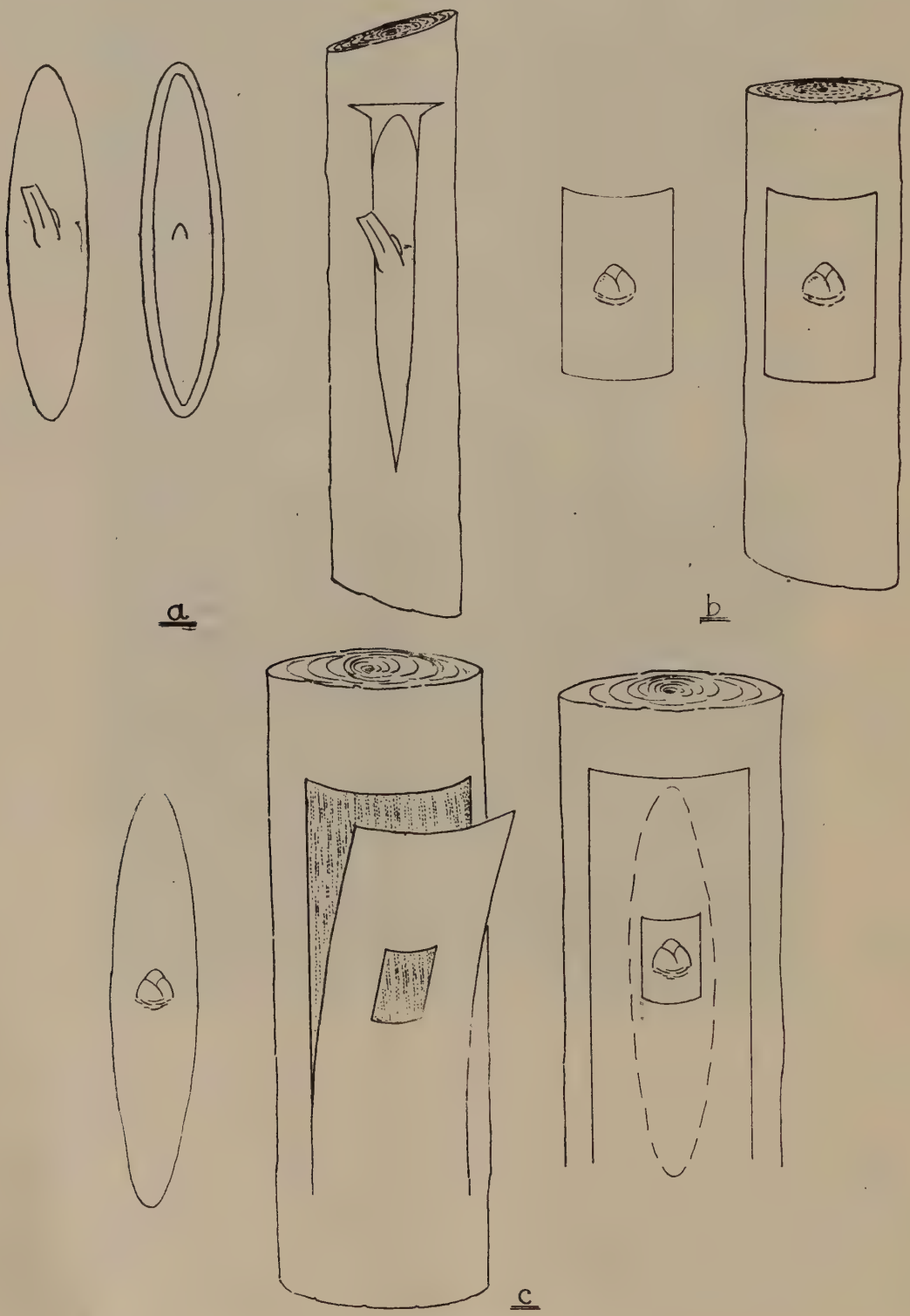


Plate 4.

Methods of Budding: a, Shield bud—bud with leaf stub protruding; inner view of bud; bud inserted in stock. b, Patch bud—bark patch with bud in centre; patch in position on stock. c, Window bud—bud; stock with raised bark flap and window; bud in position.

The bud should be inserted in the stock tree 3-6 in. above the ground according to the species, but many nurserymen work as close to the ground as practicable. The bud is usually placed on the south side of the rootstock seedlings for protection against the sun.

The correct procedure is to make a T cut on the rootstock seedling at the selected position, the vertical slit and horizontal cuts of the T being no longer than is necessary to accommodate the bud. Some nurserymen prefer an inverted T. The flaps of bark on the T are prized open ready to receive the bud.

A bud with a thin slice of bark about $1\frac{1}{4}$ in. long is cut from a bud-stick with a sharp, thin-bladed budding knife, the bud-stick being held firmly in the hand. The budding knife is inserted into the bark about $\frac{1}{2}$ in. below a bud, which is then detached with a sliding cut towards the operator. In some plants, the small wood chip below the bud may be removed before the latter is inserted into the T cut on the stock tree. When placed in position, the shield of bark with a central bud lies under the bark flaps of the T.

The bud is tied firmly in position with raffia or waxed tape, the bud and the petiole stub, if present, being left exposed.

Raffia, tape or string ties must be cut away 10-14 days after budding unless the unions are covered with soil, when they rot fairly quickly.

Modifications of the shield bud are the H bud, the patch bud, the window bud and the chip bud. In the H bud, bark cuts are made in the form of an H and the bud is inserted under the flaps. In the patch bud (Plate 4b), a rectangular piece of bark is completely removed from the stock and replaced by a piece of bark from the scion of the same size and carrying a single scion bud. The window bud (Plate 4c) is a modification of the patch bud in which a flap of bark is lifted from the stock and replaced with a shield bud from the scion underneath and protruding through an opening in the centre of the flap.

GRAFTING.

Budding is by far the most economical method of using scion material, but grafting is more widely practised in propagating some types of fruit trees. Scions should be cut with at least three prominent buds.

Whip-Tongue Graft.

The whip-tongue graft (Plate 5) is commonly employed in many deciduous-fruit nurseries, particularly when the stock and scion are less than 1 in. in diameter and about the same thickness. It is also used in top-working and in crown-grafting a tree to another variety or strain.

A sloping cut about $1\frac{1}{2}$ in. long is made on the base of the scion and also on the top of the stock. The length of the cut depends on the size of the wood being grafted; the greater the diameter, the longer the

cut surface. Starting about one-third of the way back from the tip of this cut, a reverse cut is made about half an inch deep and at an angle of about 15 degrees to it. Reverse cuts are made on both scion and stock, which are then fitted together so that the tongues slide one inside the other. If the stock and scion are not the same size, the cambiums are matched on one side only.

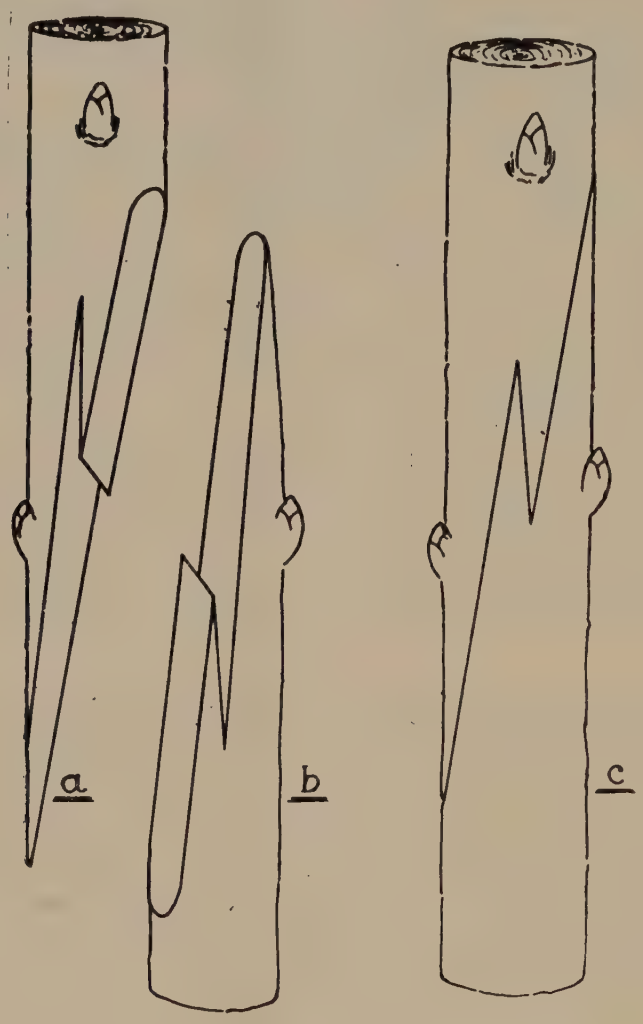


Plate 5.

Whip-tongue Graft: a, Prepared scion; b, Prepared stock; c, graft in position with stock and scion matched.

The graft union is then tied in position with raffia or tape and sealed with grafting wax.

Bark Graft.

Bark grafting (Plate 6) can only be performed during an active growing period when the bark lifts freely, and is mainly used in top-working.

The top of the tree is removed and the grafts are made in the stubs of the trunk or branches. A 2 in. slit is cut in the bark from the edge of the stub, and the bark flaps are raised slightly with the back of the knife blade. Scions are prepared with a sloping cut 2 in. long on one side and a similar but shorter cut on the opposite side. With thick scion-wood, a shoulder is cut into the scion before the long, sloping cut is made. The scion is inserted behind the bark

flaps with the longer cut inside. A small nail ($\frac{5}{8}$–$\frac{3}{4}$ in. long) is driven through the centre of the scion into the stock. The scion is then bound with tape or string and the whole of the graft, including the stub and the ends of the scions, is waxed. As many as six scions may be inserted on each stub of top-worked trees.

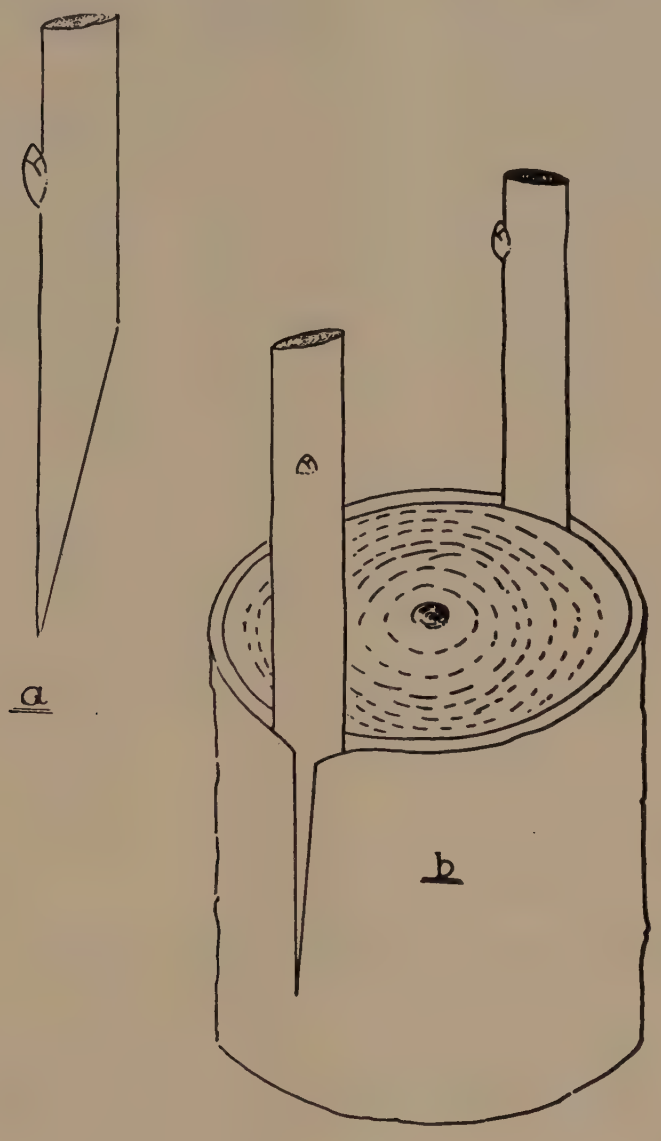


Plate 6.

Bark Graft: a, Prepared scion; b, Stock with two scions in position.

With some subtropical species, better results can be obtained by making two bark slits on the stock, one on each side of the scion after it has been shaped and placed against the stub. The chip of bark is then peeled back, the scion inserted, and the bark nailed back onto the scion and stub.

A number of other types of bark graft (Plate 7) are used for re-working deciduous fruit trees. These include the modified bark graft, the L graft, the T or ⊥ graft and the gouge graft.

In the modified bark graft, a single downward cut is made from the stub and the bark is lifted on one side only. The scion is prepared as in the usual bark graft and slipped under the bark of the stock so that the trimmed edge of the scion lines up with the cut on the stock.

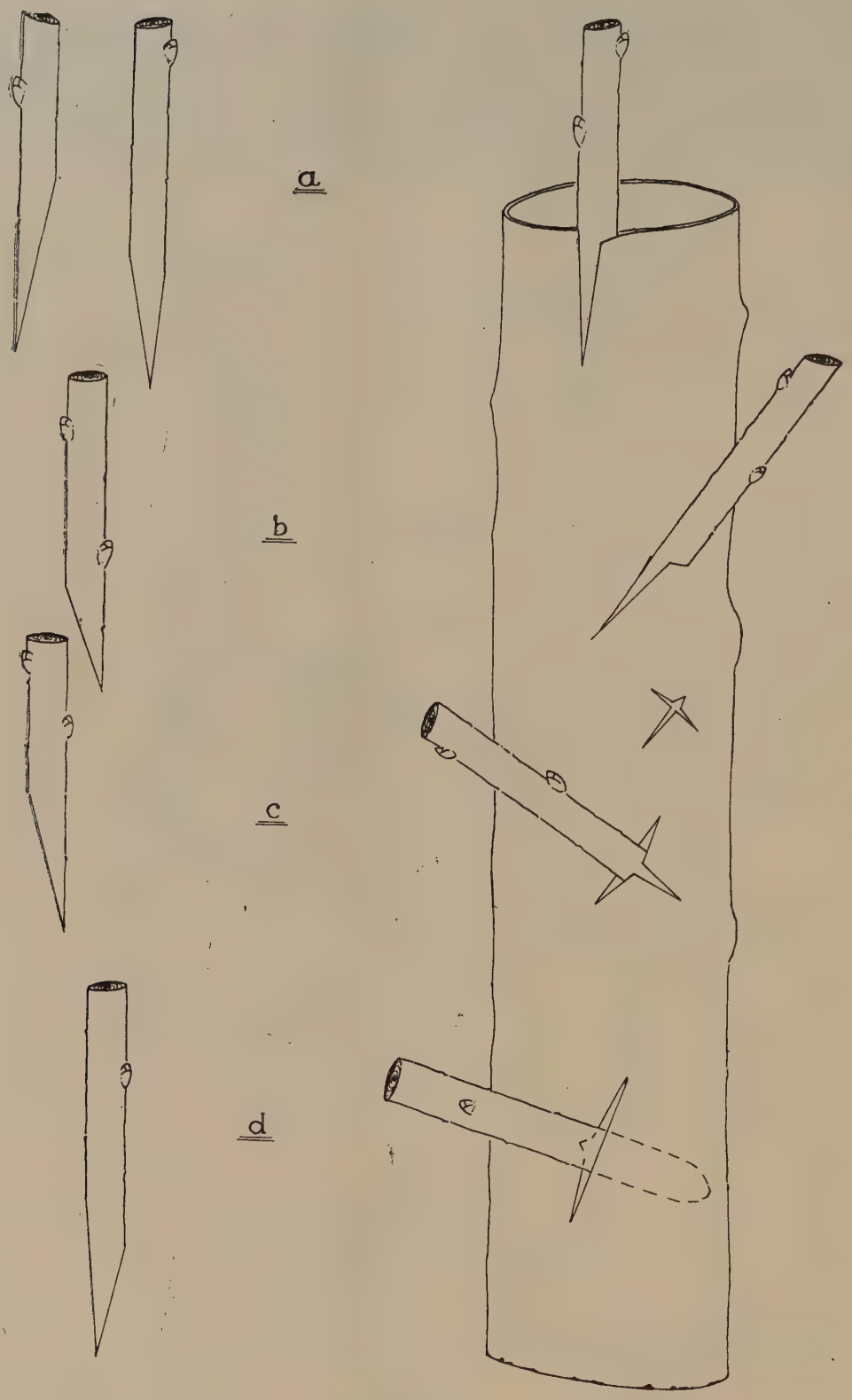


Plate 7.

Other Bark Grafts for Use in Deciduous Fruit Trees: a, Modified bark graft; b, L graft; c, T or ⊥ graft; d, gouge graft.

Side-Wedge Graft.

Side-wedge grafting (Plate 8) may be employed when the stock tree is too large for whip-tongue grafting. It is also a satisfactory method for working nursery trees with a hard, brittle wood.

With stocks about 1 in. in diameter, an oblique, downward cut is made into the centre of the stock. The scion is prepared by shaping the lower end to a wedge with two sloping cuts, one longer than the other—the longer cut being the same length as the cut made in the stock. The top of the stock is bent back to allow the insertion of

the scion, which is placed in position with the longest side of the wedge innermost and the two cambiums together on one side of the stock. The scion is then tied or nailed in position and the union and the tip of the scion waxed.

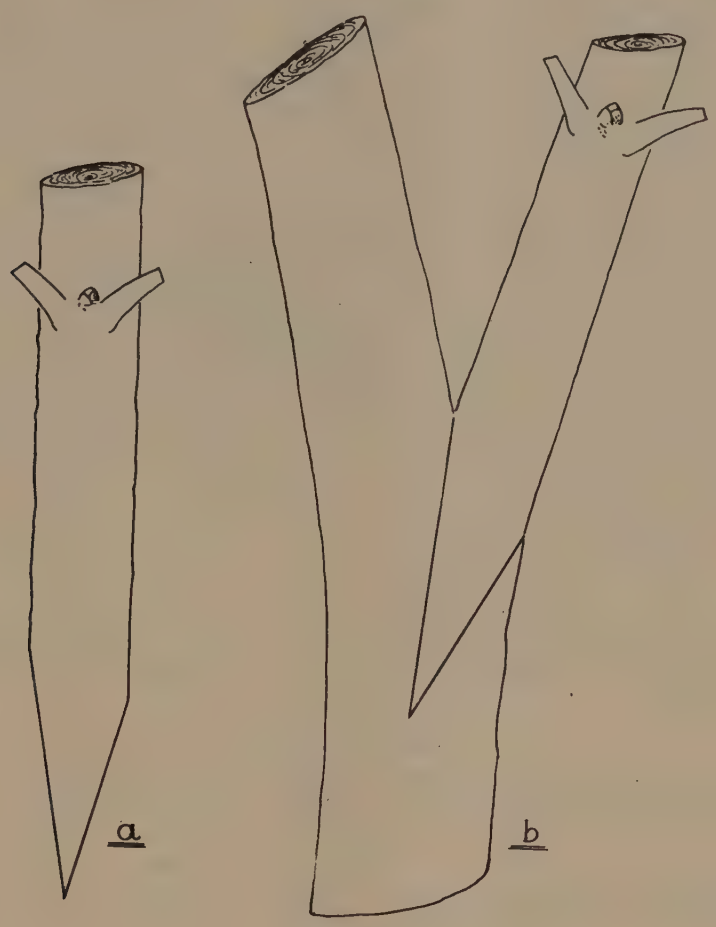


Plate 8.

Side-wedge Graft, a Method Used in Macadamia Nuts: a, Prepared scion; b, Scion in position on the stock.

If the stock and scion are less than 1 in. in diameter and approximately the same size, the procedure is slightly different. The stock is grasped with the finger-tips of the left hand, the third finger being a few inches above ground level, where the graft is to be made. An oblique, downward cut is then made rather more than half-way through the stock. Care must be taken not to split the stock. After the wedge-shaped scion is inserted in the cut on the stock, the union is bound with raffia or tape and waxed. Small worked trees of this type must be tied to a stake so that the graft will not be damaged by wind. The graft tie is cut in 14-21 days.

Cleft Graft.

The cleft graft (Plate 9) was formerly used mainly for reworking apple trees to another variety and is now a popular method of reworking grapes.

The branches of the tree are sawn off about 18 inches above the crotch. The edges are trimmed and each stub is then split open at the centre with a chisel and mallet, a wedge being used to keep the split open until scions have been inserted. The end of the scion is shaped in the form of an elongated wedge and inserted into the bark end of

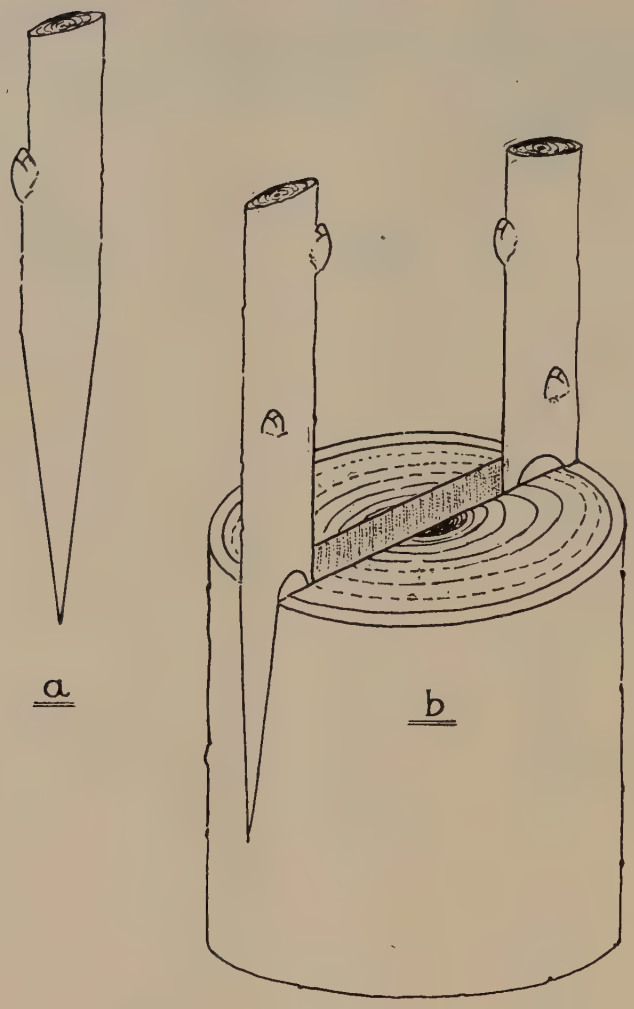


Plate 9.

Cleft Graft: a, Prepared scion; b, Scions in central cleft on stock.

the split, so that the cambium of the stock matches that of the scion. The scion is tied into position and the whole of the stub, including the cleft itself, is thoroughly waxed.

Cleft grafts are usually made during a sap flow in early spring, but as the bark has not to be lifted, the work may be done in late winter, if necessary.

Side-Cleft Graft.

Another form of side graft, the side-cleft graft (Plate 10) is sometimes used in propagating custard apples.

The scion is prepared with a long, sloping cut at one end; a second cut is then made at an angle to the first and the tip of the scion is bevelled. Corresponding cuts are made in the side of the stock tree at the point of the proposed graft. They include a sloping cut extending almost halfway through the stock, a second cut beginning at the same point as the first but at an angle of about 10 degrees from the vertical, and finally a more or less horizontal cut which removes the outer chip of wood. When fitted together, the tongues of the stock and the scion match and the bevel of the scion sits flush with the outer edge of the stock.

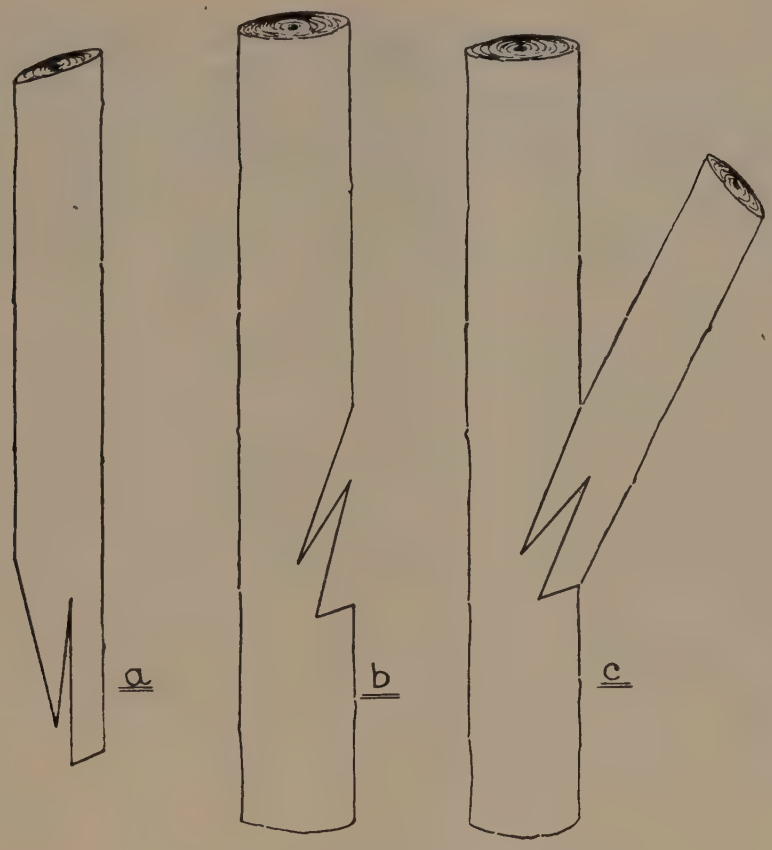


Plate 10.

Side-cleft Graft: a, Prepared scion; b, Prepared stock; c, Scion in position on stock.

Strap Graft.

The strap graft (Plate 11) is commonly used to re-furnish deciduous fruit trees at Stanthorpe.

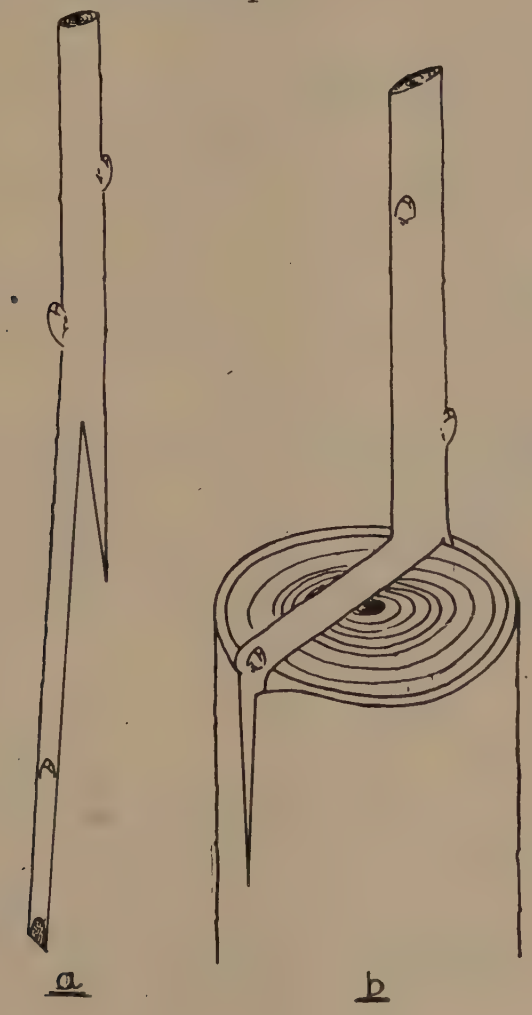


Plate 11.

Strap Graft: a, Prepared scion; b, Scion in position on stock.

The branches are first shortened back and the stubs are trimmed. On a small branch 1-2 in. in diameter for which a single scion is required, a longitudinal cut about 1½ in. long is made in the bark on the upper side of the stub, the bark then being freed. A similar but shorter cut is made on the opposite side of the stub The scion is prepared by first cutting the strap—a thin shaving of bark and wood about 1 in. longer than the diameter of the stub. The strap so formed is attached to the scion at its upper end. The wood on the opposite side of the scion is removed with a sloping cut to form a wedge about 1 in. long. Finally, a small, sloping cut is made on the outer edge of the free tip of the strap.

In fitting the scion, the wedge is inserted between the bark and the wood at the long cut on the stub, the strap being taken over the stub and its free end placed in the short cut on the opposite side. The strap must fit closely onto the top of the stub. When both the wedge and the strap are firmly in position, the graft is tied and waxed. The tie should be cut some four weeks after the graft is made.

Strap-grafts are usually made as soon as the sap flow in late winter or early spring permits the bark to lift freely. Two scions—one on each side—may be fitted to stubs which are more than 2 in. in diameter.



Plate 12.

Root Graft: a, Prepared scion; b, Stock and scion matched.

Root Graft.

The root graft (Plate 12) is mainly employed for propagating apples on free-rooting stocks such as Northern Spy, and for propagating grapes on phylloxera-resistant stocks. The work may be done indoors (bench grafting) or in the nursery. In the former case, 1-year-old rooted plants are taken up in winter, grafted, stratified and then replanted in the following spring.

When the stock diameter is less than that of the scion, it is shortened back with two sloping cuts about 1½ in. long into the form of a wedge. The scion is opened up with a single cut reaching almost to the centre, the stock and scion being then fitted into each other, tied and waxed. This graft is essentially a reverse side-graft.

When the stock diameter is equal to or greater than that of the scion, the whip-tongue graft takes precedence over the root graft as a method of propagation.

If root grafting is carried out in the nursery row, the plants are hilled up with soil to cover the union.

Inarching.

Inarching (Plate 13), or grafting by approach, is sometimes used to rejuvenate trees which are lacking in vigour because the root system is faulty. A young tree is planted beside the weak tree and its stem is grafted into the trunk. The work is carried out in early spring.

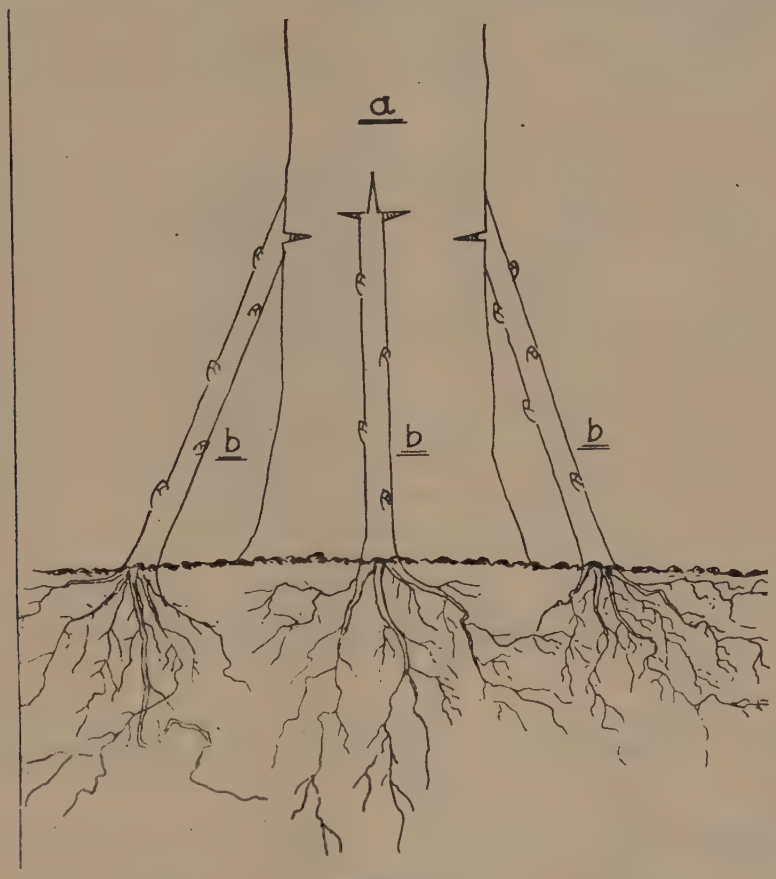


Plate 13.

Inarching or Grafting by Approach: a, Original tree; b, Young trees on their own roots grafted onto the original tree.

The graft can be made by either of two methods—the ⊥ or the slot. In the first of these, a ⊥ cut is made in the trunk about 16 in. from the ground, and a small piece of bark is cut out just below the

horizontal cut to allow the seedling stem to fit snugly. The seedling is prepared by making a sloping cut about 2 in. long at a height which allows it to fit into the ⊥ cut on the older tree. When so inserted, it is tacked into position and waxed.

In the slot method, a strip of bark about 2 in. long and the width of the seedling trunk is removed from the older tree on the side adjacent to the seedling. The seedling is prepared by making a long, sloping cut on the side facing the trunk of the older tree at the proper height, thus cutting the top off the seedling, and by a shorter cut on the opposite side. The wedge-shaped tip is then fitted into the slot on the trunk, the upper portion being pushed under the bark at the top of the slot. The seedling is held in position by a long tack or brad and the graft is sealed with wax.

During the first year after grafting, shoots on the seedling tree may be retained, but from then on they should be completely suppressed.

Bridge Graft.

The bridge graft (Plate 14) has a limited application for repairing extensive bark injury to the trunk and is sometimes a useful method of saving valuable trees.

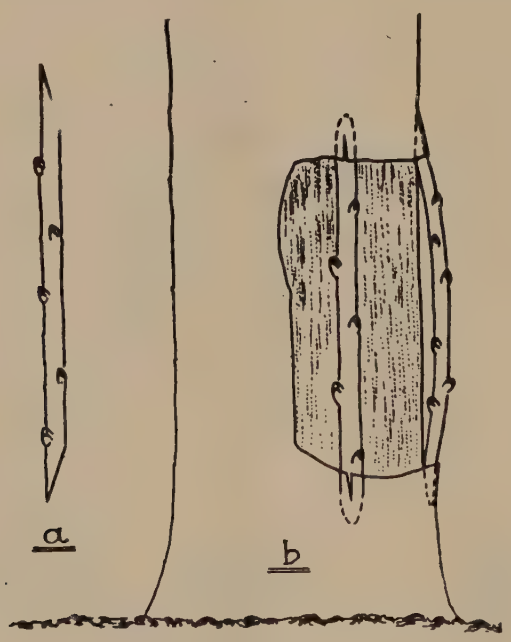


Plate 14.

Bridge Graft: a, Prepared scion; b, Scions inserted over injured part of trunk.

The injured bark is trimmed to healthy tissue and two parallel cuts are made vertically in the bark above and below the exposed wood. A scion of the right length is cut with an elongated wedge at each end. The ends of the scion are then inserted under the bark of the older tree at each cut, tacked into position, and the exposed surfaces thoroughly waxed. Several bridge grafts may be required on a badly injured tree.

Suckers arising from the trunk below the injured bark may be grafted into healthy bark higher up the trunk to take the place of the bridge grafts already described.

LAYERING.

Layering is a method of rooting stems or branches while they are still attached to the parent plant.

Simple layering consists of pegging-down a branch so that part is buried under soil and the tip is uncovered. If the buried portion of the branch is first girdled, roots will often form at the callus. The rooted branch is severed from the parent and established as a separate plant on its own roots during the dormant season. This method of propagation is commonly used for some shrubs and grapes.

Tip layering and *stool layering* are modifications of simple layering which are particularly suitable for propagating some vine plants or scramblers. Essentially the method is to cover the branch tips (tip layers) or the branch bases (stool layers) with soil to encourage root development. When detached from the parent, the rooted portions can be established as new plants.

In *trench layering,* the whole top of a young tree is pegged down in a shallow trench, and shoots are partly covered with soil to encourage root formation. The rooted shoots are later detached from the parent tree and planted out separately.

CUTTINGS.

A cutting is a piece of a twig, branch or root which is detached from the plant and placed in a rooting medium.

Hardwood cuttings are usually selected in early winter from the previous season's growth, but with some species, such as the fig, 2-year-old wood is generally used. They are usually 5-15 inches in length, with several buds, the lower cut being made immediately below a bud, and the upper cut midway between two buds. The cuttings may be stored in moist sand or moss or they can be planted in a sandy loam under partial shade in the nursery. Each is planted with one or more buds showing above the surface of the soil at spacings of 2-3 in. in the nursery row.

Root cuttings are often employed in propagating berry plants. The roots are cut in pieces 2-4 in. long and planted in a nursery row. Most raspberry and blackberry cuttings are laid horizontally at a depth of 2-3 in., but in some other plants the root cuttings are placed upright with the top of the cutting at ground level.

Cuttings of some tropical and subtropical plants root only under warm, humid conditions and in such cases specially designed propagating boxes supplying bottom heat are used. Coarse calcareous sand is an effective propagating medium, provided that the sand is kept moist.

BUDDING AND GRAFTING METHODS AND ROOTSTOCKS USED IN THE PROPAGATION OF FRUIT TREES.

Crop.	Effective Methods.		Recommended Rootstock.
	Nursery.	Re-working.	
Apple	Whip-tongue and root grafts	Cleft, strap and bark grafts	Northern Spy ; French crab seedling ; Merton 778, 789, 793 ; Local S4
Apricot ..	Whip-tongue graft ..	Bark graft ; budding in new growth	Apricot, peach, Myrobolan plum
Avocado ..	Budding	Bark graft ; budding	Mexican seedlings
Citrus	Budding	Budding in new growth ; bark graft	Sweet orange ; rough lemon
Custard apple	Side-cleft graft ..	Budding ; bark and cleft grafts	Seedlings
Fig	Cuttings	Cleft and bark grafts (take 2-yr.-old wood for scions)	Fig (cuttings)
Grape	Cuttings ; root and whip-tongue grafts	Cleft graft ; budding	Grape (phylloxera-resistant)
Macadamia nut	Side-wedge graft ..	Side-wedge graft ..	Seedlings
Mango	Window, shield and patch budding ; inarching	Budding ; grafting ..	Seedlings
Olive	Cuttings	Budding ; bark and cleft grafts	Olive (cuttings)
Peach	Whip-tongue graft ..	Bark graft ; budding	Peach seedlings
Pear	As for apple	As for apple	Pear seedlings
Pecan nut ..	Budding (shield, chip and patch) ; whip-tongue graft	Budding in new growth ; bark graft	Pecan (cuttings)
Plum	Whip-tongue graft ..	Strap and cleft grafts ; budding in new growth	Peach (cuttings) ; Myrobolan plum
Quince ..	As for apple	As for apple	Quince seedlings

Orderly Purchase of Farm Needs.

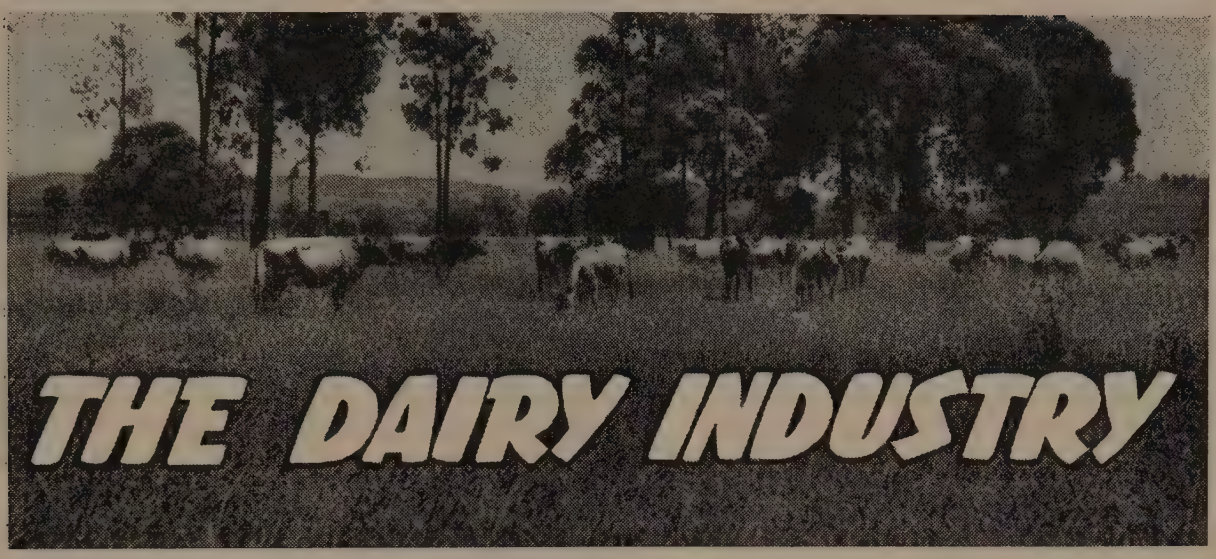
Primary producers can help to overcome the periodic difficulties in the supply position of various pest destroyers and other agricultural chemicals by informing their usual suppliers of their likely requirements for some time ahead, or, where practicable, keeping reserve stocks on the property.

Temporary shortages of insecticides, fungicides and so on have in the past seriously affected many producers. The main reasons for these shortages have been the limited availability of some raw materials to Australian manufacturers, and import difficulties. On many occasions, however, importers, manufacturers and distributors have been hampered in their efforts to maintain ample supplies by not knowing well in advance the likely requirements of certain lines.

Weather conditions can, of course, upset calculations of requirements, and forward planning of a cropping or livestock programme may be affected by many factors. Nevertheless, producers could ensure a more reliable supply position by booking or securing their needs in a somewhat more orderly fashion than has been usual.

There are many lines which are subject to deterioration in storage, and it is not recommended that these products be bought far in advance of the time at which it is intended to use them. The supplier might, however, be notified by the producer of his anticipated needs.

As the orderly distribution of materials is often disrupted by insufficient storage space in factories and warehouses, growers would be serving their own interests by taking early delivery of lines which do not deteriorate.



Report on Group Herd Recording for the Year Ending September 30, 1952.

S. E. PEGG, Chief Adviser, Herd Recording.

DURING the 12 months ending September 30, 1952, seasonal conditions varied greatly At the commencement of the period most of Queensland was in the throes of one of the worst droughts experienced for many years. In most districts relief was not received until late in February. As a result of these conditions most cows which completed lactation during the 12 months milked throughout a drought and the average production per cow was much below that of the previous years.

During the year, 45 groups were in operation, although in many cases the number of herds in each group was reduced; 23,123 cows in 818 herds completed lactation.

The total number of completed lactations and average production for each year are given in Table I.

TABLE 1.

Number of Completed Lactations and Average Production Per Cow.

Year.	No. of Herds.	No. of Lactations.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
			Lb.	%	Lb.
1948–49 ..	507	17,216	3,289	4·3	144
1949–50 ..	715	22,392	3,523	4·3	152
1950–51 ..	814	26,798	3,312	4·4	146
1951–52 ..	818	23,123	2,657	4·2	112

The decrease in the average production in 1951-52 compared with that of previous years is very largely due to drought, and stresses the need for fodder conservation to combat recurring dry seasons. The losses, both in stock numbers and in decreased production, incurred during the recent drought should serve as a lasting reminder of the need to conserve fodder. Unfortunately, in the past such good resolutions regarding the necessity for adequate fodder reserves have been forgotten soon after the season has improved, but it is hoped that a similar indifference will not be shown in the future.

Table 2 gives, according to age groups, the numbers of cows which completed lactation periods of 270 days or less, and their average production of milk and butterfat. All completed lactations are included even though due to the drought many were of short duration.

TABLE 2.

AVERAGE PRODUCTION OF COWS WHICH COMPLETED LACTATION PERIODS OF 270 DAYS OR LESS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	2,554	2,334	4·3	101
3 years	2,135	2,449	4·3	106
4 years	1,788	2,561	4·3	111
Mature	6,948	2,780	4·2	117
Unknown	9,698	2,718	4·2	113
Total	23,123	2,657	4·2	112

The Queensland Government Statistician's report on dairy cattle and milk production for the year ending March 31, 1952, shows the average production of milk per cow as 195 gallons. Using the same average butterfat content as shown in group recording (4.2%), the average butterfat production would be 82 lb.

Effect of Length of Lactation.

The average production of cows with full lactation periods of 270 days was 149 lb. butterfat, while the average production of cows with completed lactation periods of less than 270 days was 93 lb. butterfat.

Details according to age are given in Tables 3 and 4.

TABLE 3.

AVERAGE PRODUCTION PER COW, ACCORDING TO AGE, OF COWS WHICH MILKED FOR THE FULL LACTATION PERIOD OF 270 DAYS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	959	3,168	4·4	138
3 years	884	3,039	4·4	134
4 years	629	3,237	4·5	144
Mature	2,448	3,561	4·3	153
Unknown	2,954	3,697	4·2	156
Total	7,874	3,479	4·3	149

TABLE 4.

AVERAGE PRODUCTION PER COW, ACCORDING TO AGE, OF COWS WHICH COMPLETED LACTATION PERIODS OF LESS THAN 270 DAYS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	1,595	1,832	4·3	79
3 years	1,251	2,032	4·3	86
4 years	1,159	2,194	4·2	92
Mature	4,500	2,356	4·1	97
Unknown	6,744	2,290	4·1	95
Total	15,249	2,233	4·2	93

These tables show that the 34% of cows which completed a 270-day lactation period produced 149 lb. butterfat, but those with a lactation period of less than 270 days produced only 93 lb. butterfat. The former production is 60% greater than the latter, clearly indicating the value of being in a position to maintain a nutritional standard which will ensure that cows milk for a full lactation period.

The average length of completed lactations for the year 1951-52 was 209 days. The average length of lactation over the three previous years was:—

1948-49 .. .. 220 days
1949-50 .. .. 223 days
1950-51 .. .. 203 days

The average length of lactation for each age group in each district for 1951-52 is given in Table 5.

TABLE 5.

AVERAGE LENGTH OF LACTATION FOR EACH AGE GROUP ACCORDING TO DISTRICT.

District.	2-year-old.	3-year-old.	4-year-old.	Mature.	Unknown Age.	All Cows.
	Days.	Days.	Days.	Days.	Days.	Days.
Atherton Tableland ..	222	227	223	227	228	226
Mackay District	182	192	212	194	181	186
Port Curtis	228	195	210	189	227	202
Upper Burnett	196	207	222	217	198	203
Central Burnett	213	207	213	221	201	212
South Burnett	210	213	213	203	195	201
South-Eastern Queensland..	214	229	215	220	208	215
Eastern Downs	185	189	195	188	198	195
Western Downs	184	188	191	182	181	184
All Queensland ..	207	217	211	213	204	209

Production per Cow.

Table 6 shows the average production per cow in each of the herd recording groups.

TABLE 6.

AVERAGE PRODUCTION PER COW, NUMBER OF HERDS AND NUMBER OF COWS WHICH COMPLETED LACTATION IN THE VARIOUS GROUPS, 1951–52.

Group.	Herds.	Cows.	Length of Lactation.	Milk.	Test.	Butterfat 1951–52.	Butterfat 1950–51.
			Days.	Lb.	%	Lb.	Lb.
Beaudesert ..	20	817	215	3,116	4·2	131	170
Biggenden.. ..	21	485	228	2,559	4·4	114	105
Boonah District ..	15	243	216	2,815	4·4	124	149
Burncluith ..	14	440	174	1,851	3·7	68	100
Cedar Pocket ..	15	422	231	2,817	4·8	135	162
Coomera	18	1015	200	2,525	3·9	98	..
Cooroy No. 1 ..	19	613	215	2,227	4·4	99	145
Cooroy No. 2 ..	21	661	218	2,314	4·2	98	133
Eungella	19	493	186	2,046	4·6	95	106
Gayndah	7	55	220	2,526	4·2	107	..
Goomeri	17	610	194	2,128	4·0	85	117
Gympie	14	278	219	2,028	4·3	88	122
Kenilworth ..	18	646	224	2,396	4·6	108	157
Kilcoy	19	833	176	2,086	4·4	92	124
Kilkivan	15	392	216	1,737	4·2	73	..
Killarney	11	213	151	2,247	3·9	88	171
Kingaroy No. 1 ..	20	451	188	1,988	4·0	79	136
Kingaroy No. 2 ..	22	403	211	3,150	3·7	118	138
Maidenwell ..	8	343	213	2,349	4·1	96	..
Malanda No. 1 ..	24	813	229	3,982	4·1	162	195
Malanda No. 2 ..	21	717	229	3,740	3·9	145	207
Malanda No. 3 ..	23	332	212	3,168	4·0	128	160
Maleny No. 1 ..	19	726	236	2,976	4·7	138	170
Maleny No. 2 ..	21	917	222	2,772	4·6	128	176
Mapleton-Kureelpa	24	564	237	2,703	4·4	119	137
Maryborough ..	25	405	169	1,459	4·4	64	..
Merrimac-Mudgeeraba	19	613	207	2,222	4·0	90	..
Miles	10	440	194	2,780	3·9	107	136
Millaa Millaa ..	21	707	226	3,371	4·5	153	186
Miva-Theebine ..	16	590	231	2,005	4·5	90	127
Monto	22	673	203	3,159	4·0	127	159
Mount Tamborine	24	551	214	2,456	4·5	111	147
Mundubbera ..	14	304	186	2,065	4·4	91	64
Oakey No. 1 ..	14	273	168	2,214	4·1	91	135
Oakey No. 2 ..	23	685	216	3,761	4·0	152	191
Oakey No. 3 ..	17	478	178	2,806	3·7	105	163
Pittsworth ..	16	430	220	3,936	4·0	157	186
Pomona	22	656	236	2,117	4·4	93	133
Tansey	19	570	201	2,417	4·3	105	132
Toogoolawah ..	19	527	214	2,736	4·3	117	129
Toowoomba No. 1	15	270	187	2,652	4·0	106	174
Toowoomba No. 2	19	323	175	2,183	4·1	89	150
Wallaville ..	14	173	202	2,180	4·7	103	64
Warra	23	639	185	2,566	3·9	101	149
Warwick	17	334	218	3,529	4·4	154	166

Value of Continuous Recording.

The value of herd recording is illustrated in Table 7, which shows the number of cows and the average production per cow of a herd whose owner has made excellent use of the information given by the scheme in applying the results to his herd management.

TABLE 7.

PRODUCTION RECORDS OF A HERD WHICH HAS SHOWN AN IMPROVEMENT IN PRODUCTION EACH YEAR SINCE RECORDING WAS COMMENCED.

Year.	No. of Cows.	Average Production.			Increase in Total Production Over 1948–49.
		Milk.	Test.	Butterfat.	
		Lb.	%	Lb.	%
1948–49 ..	49	2,613	5·2	137	..
1949–50 ..	53	3,248	5·2	169	33
1950–51 ..	44	4,285	5·2	221	45
1951–52 ..	44	4,418	5·1	225	47

The table shows that despite the drought the production of the herd showed an increase for the fourth year, when the average production per cow was 64% greater than that of the first year of recording and the total production of the herd 47% greater. It is results such as these that illustrate the potential production likely from many herds and farms when properly managed.

Production According to District, Age and Size of Herd.

Table 8 gives the average production per cow according to the main districts of the State.

TABLE 8.

AVERAGE PRODUCTION PER COW ACCORDING TO THE MAIN DISTRICTS OF THE STATE.

District.	Herds.	Cows.	Average Production.		
			Milk.	Test.	Butterfat.
			Lb.	%	Lb.
Atherton Tableland ..	89	2,569	3,641	4·1	150
Mackay District	19	493	2,046	4·6	95
Port Curtis..	14	173	2,180	4·7	103
Upper Burnett	22	673	3,159	4·0	127
Central Burnett	42	844	2,379	4·4	105
South Burnett	104	2,769	2,286	4·0	93
South-Eastern Queensland	349	11,077	2,462	4·4	108
Eastern Downs	132	3,006	3,091	4·0	125
Western Downs	47	1,519	2,421	3·9	93

The average production of butterfat in the lowest and highest producing herds in each district according to herd size is shown in Table 9.

TABLE 9.

AVERAGE PRODUCTION OF BUTTERFAT OF THE LOWEST AND HIGHEST HERDS IN EACH DISTRICT ACCORDING TO SIZE OF HERD.

District.	Average Production of Butterfat.									
	1–10 Cows.		11–20 Cows.		21–50 Cows.		51–100 Cows.		Over 100 Cows.	
	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Atherton Tableland ..	52	184	100	151	77	215	118	251	..	..
Mackay District	95	140	80	206	65	115	67	109	..	..
Port Curtis	54	111	84	160	45	105	..	..	..	..
Upper Burnett	23	257	110	240	78	144	111	148	..	..
Central Burnett	4	184	66	173	78	143	71	160	..	..
South Burnett	3	200	32	158	26	227	61	189	..	..
South-Eastern Queensland	3	203	11	175	18	205	64	198	86	146
Eastern Downs	12	217	28	281	14	202	50	211	..	..
Western Downs	7	158	59	185	21	155	39	155	..	..

TABLE 10.

Number and Percentage of Cows Grouped According to Age.

Age Group.		Under 50 Lb.	50–99 Lb.	100–149 Lb.	150–199 Lb.	200–249 Lb.	250–299 Lb.	300–349 Lb.	350–399 Lb.	400–449 Lb.	450–499 Lb.	Over 500 Lb.	Total.
2 years	No.	486	794	843	303	100	25	3	..	..	..	..	2,554
	%	19·03	31·09	33·01	11·86	3·92	·98	·12	..	..	..	..	..
3 years	No.	297	692	749	293	78	24	1	1	..	..	..	2,135
	%	13·91	32·41	35·08	13·72	3·65	1·12	·05	·05	..	..	..	..
4 years	No.	262	538	588	276	95	23	6	..	..	..	..	1,788
	%	14·65	30·09	32·89	15·44	5·31	1·29	·34	..	..	..	..	..
Mature	No.	912	1,946	2,229	1,256	435	123	36	6	4	1	..	6,948
	%	13·13	28·01	32·08	18·08	6·26	1·77	·52	·09	·06	·01	..	..
Unknown	No.	1,563	2,617	2,984	1,689	618	177	37	11	2	..	..	9,698
	%	16·12	26·98	30·77	17·42	6·37	1·83	·38	·11	·02	..	..	..
Total	No.	3,538	6,564	7,388	3,830	1,323	372	83	18	6	1	..	23,123
	%	15·30	28·39	31·95	16·56	5·72	1·61	·36	·08	·03	·004	..	..

Some of the very low productions were from herds which owing to drought withdrew from recording after only a few cows had been recorded and dried off.

Table 10 shows the number and percentage of cows in various butterfat ranges according to ages. It is noted that of the 23,123 cows which completed their lactation, 10,102 (43.69%) produced less than 100 lb. butterfat.

Seven cows produced over 400 lb. butterfat, one producing over 450 lb. This cow is owned by Mr. R. S. Griffiths, Moregatta, Atherton Tableland. She is a 9-year-old A.I.S. cow and in 270 days produced 9,195 lb. milk and 455 lb. butterfat with an average butterfat content of 4.9%.

Table 11 shows the number and percentage of herds in each district in various production ranges. It is noted that 43.9% of the herds had an average production of less than 100 lb. butterfat, while only 3·4% averaged over 200 lb. butterfat.

TABLE 11.

NUMBER AND PERCENTAGE OF HERDS IN VARIOUS BUTTERFAT PRODUCTION RANGES, 1951–52.

District.		Total No. of Herds.	Under 100 Lb.	100–149 Lb.	150–199 Lb.	200–249 Lb.	250–299 Lb.	300 Lb. Over
Atherton Tableland	No.	89	12	44	25	7	1	..
	%	..	13·5	49·4	28·1	7·9	1·1	..
Mackay District	No.	19	12	6	..	1	..	..
	%	..	63·2	31·6	..	5·2	..	..
Port Curtis..	No.	14	6	7	..	..	..	..
	%	..	42·9	50·0	7·1	..	..	..
Upper Burnett	No.	22	4	13	3	1	1	..
	%	..	18·2	59·1	13·6	4·5	4·5	..
Central Burnett	No.	42	24	14	4	..	..	..
	%	..	57·1	33·3	9·5	..	..	..
South Burnett	No.	104	68	26	8	2	..	..
	%	..	65·4	25·0	7·7	1·9	..	..
South-Eastern Queensland	No.	349	168	139	37	5	..	..
	%	..	48·1	39·9	10·6	1·4	..	..
Eastern Downs	No.	132	39	56	27	7	3	..
	%	..	29·5	42·4	20·4	5·3	2·3	..
Western Downs	No.	47	26	18	3	..	..	..
	%	..	55·3	38·2	6·4	..	..	..
All Queensland	No.	818	359	323	108	23	5	..
	%	..	43·9	39·5	13·2	2·8	0·6	..

Highest Producing Herds.

The herds having the highest average production in the State during the 12 months were as follows:—

The herd of Mr. A. M. Lee, Goomburra, Eastern Downs, which had the highest average production for the year 1950-51, again had the highest average production. This year 17 cows completed lactation for an average production of 5,163 lb. milk and 281 lb. butterfat, the average butterfat content being 5·4%. During the year the herd was grazed on natural pastures and cultivated crops, and was also fed a supplementary ration of crushed grain.

This Jersey herd has produced consistently during the last four years, the figures being set out below.

Year.	Cows.	Average Lactation.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
		Days.	Lb.	%	Lb.
1948–49 ..	18	253	5,892	4·3	256
1949–50 ..	19	245	4,490	4·6	208
1950–51 ..	20	270	5,728	5·1	293
1951–52 ..	17	259	5,163	5·4	281

Mr. Lee's 17 cows consisted of three 2-year-olds, two 3-year-olds, five 4-year-olds and seven mature cows.

The second highest herd was owned by Mr. H. Geise, Pittsworth, Eastern Downs. This A.I.S. grade herd of 13 cows had an average production of 6,358 lb. milk and 262 lb. butterfat (average butterfat content 4·1%), and an average lactation period of 240 days. Mr. Geise commenced recording in September, 1950, and for the year 1950-51 his herd of 20 cows averaged 6,311 lb. milk and 258 lb. butterfat (average butterfat content 4.1%).

The position of third highest herd was shared by two A.I.S. herds, those of Mr. R. S. Griffiths, Moregatta, Atherton Tableland, and Mr. W. Bourke, "College Green," Clifton, Eastern Downs.

Mr. Griffiths' herd, which last year occupied the position of second highest herd, had 51 cows with completed lactations for an average production of 5,986 lb. milk and 251 lb. butterfat. This herd, which has been recorded since the inception of herd recording on the Atherton Tableland in 1948, has given the following average production:—

Year.	Cows.	Average Lactation.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
		Days.	Lb.	%	Lb.
1949–49 ..	29	261	5,833	4·3	252
1949–50 ..	32	258	6,107	4·4	269
1950–51 ..	52	254	6,554	4·4	287
1951–52 ..	51	252	5,986	4·2	251

Mr. W. Bourke had 16 cows which completed lactation for an average production of 6,270 lb. milk and 251 lb. butterfat (average butterfat content 4.0%). The average length of lactation was 242 days.

Register of Merit for Dairy Cattle (First Supplementary List).

S. E. PEGG, Chief Adviser, Herd Recording.

A REGISTER of Merit for Dairy Cattle was instituted by the Department in 1952 and the list of entries as compiled to June 30, 1952, appeared in this journal for September, 1952. Accompanying the list were the reasons for instituting the register and the rules governing registration.

Research into the records has been continued and it has been found that a further 32 cows and 2 bulls are eligible for entry into various sections of the register, as follows:—

Elite section	1
Lifetime section	7
Intermediate section	24
Sires section	2

This brings the total number of cows in the register to 105 and the number of sires to 3.

Table 1 shows, according to breed, the number of cows which have qualified for entry into the register as compiled to December 31, 1952.

Two more bulls, both Jerseys, have qualified for entry into the Sires Register of Merit. This makes a total of three animals in the register—1 A.I.S. and 2 Jerseys.



Plate 1.

"Navillus Charm 17th," owned by Mr. C. O'Sullivan, "Navillus," Greenmount. This animal is in the Lifetime Register of Merit with a production of 82,371 lb. milk and 3,281 lb. butterfat in seven lactations.



Plate 2.

"Trecarne Rosella 4th" was owned and bred by the late Mr. T. Petherick, "Trecarne" Jersey Stud, Lockyer. She qualified for entry into the Elite Register of Merit with a production of 74,936 lb. milk and 4,118 lb. butterfat in nine lactations.

TABLE 1.

Composition of Register of Merit (Females).

Section.	Breed.					Total.
	A.I.S.	Ayrshire.	Friesian.	Guernsey.	Jersey.	
Intermediate..	21	1	..	2	60	84
Lifetime ..	7	..	1	1	10	19
Elite	1	..	..	..	1	2

All the additional animals included in the register are shown in Tables 2-5, which are compiled in alphabetical order according to breed and owner. Animals which have further lactation records since the original list was published are also shown.

Trecarne Rosella 4th qualified for entry into the Elite section with a production of 74,936 lb. milk and 4,118 lb. butterfat in nine lactations. She commenced her first lactation record at the age of 1 year 10 months and her final lactation at 11 years 11 months. She was born on 25-8-29.

This cow was bred by the late Mr. T. Petherick, of "Trecarne" Jersey Stud, Lockyer. She was sired by Trinity Officer and her dam was Sultane's Rosella of Brookland. Trinity Officer was used with success first in the "Trecarne" stud and later in the "Glenview" stud at Biggenden. He has 23 recorded daughters with 44 lactations and an average production of 349 lb. butterfat.

Sires Register of Merit.

The two Jersey bulls which have qualified for entry into the register are Bellgarth Stylish and Trinity Some Officer.

Bellgarth Stylish (H.B. 10878) has four daughters in the Intermediate section and one in the Lifetime section of the register. These five daughters averaged 373 lb. butterfat from 19 lactations. In all, Bellgarth Stylish has 18 daughters which have been recorded for a total of 55 lactations, for an average production of 347 lb. butterfat. This bull was bred by Mr. D. R. Hutton, "Bellgarth," Cunningham, and was used in the stud of the late Mr. P. Kerlin, "Glenrandle," Killarney. He was sired by Trecarne Renown 2nd and his dam was Woodlands Fashion, who is in the Intermediate section.

Trinity Some Officer (H.B. 6798) has three daughters in the Intermediate section and two in the Lifetime section of the register. These five daughters were recorded over a total of 22 lactations for an average production of 423 lb. butterfat. Altogether, 19 daughters have been recorded over 44 lactations for an average production of 369 lb. butterfat. Trinity Some Officer was bred by Messrs. J. Sinnamon and Sons, "Trinity," Moggill, and was used in the "Trecarne" stud, Lockyer. His sire was Somehope (Imp.) and his dam was Trinity Hazeldale.

TABLE 2.

Intermediate Register of Merit (First Supplementary List).

Name of Cow. (*Name of Sire.*)	Herd Book No.	Date of Beginning of Record.	Age.	Production Records.		
				Milk.	Average Test.	Total Butterfat.
			Yrs. Mths.	Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN.						
R. S. Griffiths, "Fernhome," Moregatta.						
Fernhome Bonnie	57709	1–1–49	3 5	8,508	4·5	387
(*Glengarry Gem's Royal*)	4854	1–6–50	4 9	9,285	4·2	391
	..	13–8–51	6 1	8,790	4·0	354
Fernhome Charity 2nd	57711	24–7–48	3 0	8,712	4·4	380
(*Glengarry Gem's Royal*)	4854	20–11–49	4 4	8,040	4·4	359
	..	6–11–50	5 3	9,105	4·3	391
Fernhome Marion	36471	25–3–48	7 2	8,750	4·6	402
(*Glengarry Gem's Royal*)	4854	16–4–49	8 3	7,790	4·6	359
	..	13–7–50	9 6	8,325	4·4	369
GUERNSEY.						
A. Ruge and Son, "Woowoonga," Biggenden.						
Springvale Verla	19876	9–10–49	2 7	8,517	5·3	455
(*Moongi Lloyd George*)	7657	18–11–50	3 8	8,286	4·9	407
	..	21–12–51	4 9	9,667	4·6	446
JERSEY.						
R. J. Browne, "Hill 60," Yangan.						
Nairfale Brown Belle	42734	26–5–46	3 3	7,341	5·2	384
(*Nairfale Count's Prominence*)	19871	12–6–47	4 4	7,687	5·0	387
	J.S.B.A.	30–6–48	5 5	6,620	5·1	339
Nairfale Lena	42731	15–9–49	5 2	7,500	5·0	377
(*Nairfale Golden Reality*)	17826	7–8–50	6 1	7,371	5·3	390
	J.S.B.A.	26–7–51	7 0	7,245	4·9	356
E. Burton and Sons, "Oxford," Wanora.						
Oxford Jezebel	26784	21–7–39	1 11	7,314	5·7	420
(*Oxford Daffodil's King*)	8131	10–7–40	2 10	8,443	5·6	475
	..	14–7–41	3 11	10,949	5·9	644

TABLE 2—*continued.*

INTERMEDIATE REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST)—*continued.*

Name of Cow. (*Name of Sire.*)	Herd Book No.	Date of Beginning of Record.	Age.	Production Records.		
				Milk.	Average Test.	Butterfat Total.
			Yrs. Mths.	Lb.	%	Lb.
R. J. CRAWFORD, "INVERLAW," KINGAROY.						
Inverlaw Patsy	24383	11–9–38	1 11	5,974	5·4	322
(*Oxford Royal Lad*)	8001	4–9–39	2 11	8,263	5·7	475
	..	21–10–40	4 1	8,222	5·5	456
FARM HOME FOR BOYS, "WESTBROOK," WESTBROOK.						
Westbrook Safety 14th	21346	19–1–38	2 4	6,440	5·0	322
(*Oxford Gem's Ambassador*)	6440	21–2–39	3 4	8,971	5·2	468
	..	20–2–40	4 5	8,806	5·0	437
F. P. FOWLER, "GLENVIEW," COALSTOUN LAKES.						
Glenview Sultan's Majesty	13058	13–3–34	2 8	7,579	5·3	398
(*Trinity Officer*)	1513	10–6–35	3 11	9,356	5·5	517
	..	4–7–36	4 11	10,344	5·3	553
Glenview Twinkle	24454	7–12–38	2 4	6,764	4·7	316
(*Trinity Governor's Hope*)	5730	18–3–40	3 7	7,763	4·5	348
	..	17–8–41	5 0	10,808	4·9	530
J. HUNTER AND SONS, "PINEVIEW," BORALLON.						
Shamrock Farm Jean	3502	30–4–32	9 7	8,532	6·3	537
(*Shamrock Farm Palatine*)	1102	29–4–33	10 7	9,634	6·0	574
	..	20–4–34	11 7	8,720	6·3	551
D. R. HUTTON, "BELLGARTH," CUNNINGHAM.						
Bellgarth Fashion 2nd	32610	20–6–42	2 3	7,946	4·4	347
(*Trecarne Renown 2nd*)	5546	23–6–43	3 3	7,762	5·0	386
	..	11–7–44	4 3	8,463	4·6	390
Woodlands Fashion	20640	12–10–36	2 1	5,742	5·1	295
(*Kenmore Victor*)	3895	4–11–37	3 2	7,383	5·2	383
	..	24–2–39	4 6	8,182	5·1	417

P. Kerlin, "Glenrandle," Killarney.							
Glenrandle Golden Girl	36169	2–7–47	5 11	7,229	5·7	411
(*Bellgarth Stylish*)	10878	25–10–48	7 3	7,793	5·4	420
	..	7–4–50	8 8	6,800	5·7	392
Glenrandle Joan	50015	10–2–49	2 2	7,048	5·5	387
(*Gem Rodney*)	15568	9–4–50	3 4	6,219	5·7	357
	..	20–2–51	4 2	6,122	6·1	374
Glenrandle Larkspur	41027	3–9–45	1 11	8,089	5·6	450
(*Bellgarth Glory King*)	12971	22–11–46	3 2	8,218	5·4	443
	..	1–1–48	4 3	8,912	5·4	484
J. B. Keyes, "Wyreene," Gowrie Little Plain.						
Greenstock Poppy	9952	20–6–31	1 5	7,054	4·7	330
(*Greenstock Commander*)	2779	16–7–32	2 5	9,318	5·2	480
	..	6–9–33	3 7	8,842	4·7	417
J. S. McCarthy, "Glen Erin," Greenmount.						
Glen Erin Princess 2nd	51594	15–8–49	2 1	7,048	4·8	343
(*Ashfield Prometheus*)	18258	5–7–50	2 11	7,396	5·3	388
	..	11–7–51	3 11	9,110	4·9	446
T. A. Petherick, "Trecarne," Lockyer.						
Trecarne Eileen 7th	24267	17–8–38	1 11	4,534	6·5	294
(*Trinity Some Officer*)	6798	23–8–39	2 11	7,001	6·6	461
	..	28–7–40	3 10	6,953	6·9	483
Trecarne Jersey Maid 3rd	22307	22–8–39	3 10	7,272	5·9	432
(*Trinity Some Officer*)	6798	11–8–40	4 10	7,386	5·5	409
	..	27–8–41	5 10	7,425	5·6	413
J. Sinnamon and Sons, "Trinity," Moggill.						
Trinity Princess Royal 2nd	34635	19–7–44	2 0	5,543	5·4	302
(*Trinity Crowning Effort*)	12311	22–7–45	3 0	6,884	5·9	403
	..	29–7–46	4 0	8,120	5·7	459
R. A. Slaughter, "Cleeve," Clifton.						
Trecarne Jean	11618	11–10–32	1 11	7,628	4·9	375
(*Mascot of Brasseldale*)	3618	9–11–33	2 11	7,684	5·1	392
	..	18–10–34	3 11	5,681	5·4	309
H. Sigley, "Myrtledale," Jaggan.						
Palm Ridges Sylvinia	32912	5–9–46	6 2	9,618	5·3	513
(*Overlook Financier*)	14991	17–11–47	7 5	10,023	5·8	588
	..	25–11–48	8 5	9,984	5·2	515

TABLE 3.

LIFETIME REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST).
(2,240 Lb. Butterfat Minimum).

Name of Cow.	Herd Book No.	Age at Start of Recording.	Age at Commencement of Last Test.	No. of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book No. of Sire.
		Yr. Mth.	Yr. Mth.		Lb.	%	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN.									
C. O'SULLIVAN, "NAVILLUS," GREENMOUNT.									
*Navillus Charm 17th ..	45661	3 0	8 10	7	82,371	4·0	3,281	Greyleigh Eros ..	2193
W. H. THOMPSON, "ALFA VALE," NANANGO.									
Alfa Vale Model 3rd ..	6291	1 11	8 0	5	53,811	4·3	2,331	Reward of Fairfield ..	1769
JERSEY.									
R. J. BROWNE, "HILL 60," YANGAN.									
Nairfale Likeness	42730	2 0	7 0	6	49,984	4·9	2,463	Nairfale Golden Recorder	19872 J.S.B.A.
H. COCHRANE, "FAUVIC," KIN KIN.									
Fauvic Rejoice	6267	8 3	14 8	6	40,766	6·0	2,442	Zingara King	1682
P. KERLIN, "GLENRANDLE," KILLARNEY.									
Glenrandle Fashion Lady..	39201	1 8	8 1	7	39,999	5·6	2,260	Bellgarth Stylish ..	10878
T. A. PETHERICK, "TRECARNE," LOCKYER.									
Trecarne Chimes 2nd ..	15997	2 0	7 11	6	41,363	5·7	2,378	Trecarne Golden King	3030
Trecarne Rosella	6611	4 1	12 1	6	46,339	5·8	2,686	Trinity Officer ..	1513

* Additional record included.

TABLE 4.

ELITE REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST).
(3,600 Lb. Butterfat Minimum.)

Name of Cow.	Herd Book No.	Age at Start of Recording.	Age at Commencement of Last Test.	No. of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book No. of Sire.
		Yr. Mth.	Yr. Mth.		Lb.	%	Lb.		
JERSEY.									
T. A. PETHERICK, "TRECARNE," LOCKYER.									
Trecarne Rosella 4th ..	10586	1 10	11 11	9	74,936	5·5	4,118	Trinity Officer ..	1513

TABLE 5.

SIRES REGISTER OF MERIT.

Name of Sire (Breed).	Herd Book No.	Intermediate Register of Merit.		Elite and Lifetime Registers of Merit.		Total Daughters in Registers of Merit.			Total Daughters Recorded.		
		No. of Daughters.	Average Butterfat.	No. of Daughters.	Average Butterfat.	No. of Daughters.	Lactations.	Average Butterfat.	No. of Daughters.	Daughters' Total Lactations.	Recorded Average Butterfat.
			Lb.		Lb.			Lb.			Lb.
W. H. THOMPSON, "ALFA VALE," NANANGO.											
* Reward of Fairfield (A.I.S.)	1769 IMSHB	5	599	4	594	9	42	595	44	89	461
P. KERLIN, "GLENRANDLE," KILLARNEY.											
Bellgarth Stylish (Jersey)	10878	4	382	1	323	5	19	373	18	55	347
T. A. PETHERICK, "TRECARNE," LOCKYER.											
Trinity Some Officer (Jersey)	6798	3	402	2	437	5	22	423	21	46	371

* Additional records included.



Some Notes on Pig Feeding.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE importance of correct feeding as a factor in economical pig production is indicated by the fact that feed represents a very large proportion of the total cost of production. The farmer who expects to make maximum profits should, therefore, realise the significance of suitable rations and proper methods of feeding.

Pigs are kept on many farms as a means of marketing the surplus grain produced and to utilize dairy by-products. The feeder should have some knowledge of the suitability of the variety of feeds available and, at the same time, realize that complete success cannot be achieved unless thought and care are given to organization, management, layout of the piggery, selection of good quality breeding stock and a high standard of sanitation.

Feeding can influence the quality of the flesh produced and fat development, but breeding also carries weight and good quality breeding stock should always be used. Prime quality pigs are only produced by proper selection of breeding stock, combined with right feeding and good sanitation.

The body development of growing pigs is continually changing, and experimental work has shown that some parts of the body develop more quickly than other parts. In the first stage, partly before birth, bone development predominates; during the second stage, muscular growth takes precedence; in the third stage, the greatest tendency is to fat development. Early-maturing pigs pass through all stages more rapidly than late-maturing pigs.

Consideration of these factors indicates that, to obtain desirable development of the carcase, pigs should be well fed during the stage when muscular growth predominates—that is, up to light porker stage.

PRINCIPLES OF FEEDING.

Feeds are usually divided into two classes—concentrated feeds, or concentrates; and bulky feeds, commonly called roughages.

The seed of all plants, whole or ground, and all such feeds as are produced from the by-products of commercial establishments, supply a large amount of nutriment in small bulk, and are called concentrates. The "body" of plants, in the form of hay, straw, green feed, pastures, and root crops, gives bulky feed or roughage.

The function of bulk in a ration is more than the mere provision of nutriment; in a mechanical way it aids digestion, for the stomach has to be comfortably filled to produce contentment. The pig, however, requires less bulky feeds than other domestic animals, but it has been found that bulk or roughage, to some extent, is very valuable in the profitable production of pork. Where roughage is not supplied and the animal is fed exclusively on concentrates, derangement of digestion usually results.

Food Constituents.

From a chemical standpoint, the constituents of feed which immediately concern the pig feeder are the nitrogenous substances, the carbohydrates and fats, and the minerals. The first-named, generally termed proteins, are used chiefly for the development of flesh. The carbohydrates, embracing starches, sugar, &c., together with the fats and oils, are used for making fat and for the supply of body heat and energy. Mineral matter or ash is not only valuable in bone-forming processes, but is necessary for the normal functioning of every organ of the body.

When feed is utilized in the animal body, a certain amount of heat is generated. This heat is converted into energy, which is necessary wherever work is performed. The term "work," however, has a very wide meaning and denotes more than actual muscular effort; for, in fact, the performance of nearly every function of the body is actually some form of work, involving the expenditure of energy. It is readily apparent that the heat-producing powers of feed have a much more important function than merely the maintenance of bodily warmth.

In selecting food for stock, consideration should be given to the appetising character of the food, its flavour and digestibility, its laxative or constipating character and its cost. We must take into account the quantities needed to make a balanced ration and the increase of food required during cold weather.

Importance of Balancing a Ration.

A ration should, therefore, be properly balanced with proteins, fats, and carbohydrates, contain a sufficiency of mineral matter, and be suitable as to digestibility and bulk.

To balance a ration or obtain the nutritive ratio, which denotes the number of parts by weight of digestible carbohydrates and fats associated in the food with one part of digestible protein, multiply the percentage of digestible fat by 2·25 (because 1 lb. of fat is approximately as effective as 2·25 lb. of carbohydrates) and add this to the percentage of digestible carbohydrates; then divide by the percentage of digestible protein. When this ratio is more than 1 to 7·0 the ratio is said to be wide; when less than 1 to 4·0 it is said to be narrow.

Suitable Nutritive Ratios.

The following nutritive ratios will be found to be suitable for the different classes of stock:—

Weaners	1 to 4·0
Stores	1 to 4·5 to 1 to 5·0
Fattening Pigs	1 to 5·0 to 1 to 5·5
Baconers	1 to 6·0 to 1 to 7·0
Sows in Milk	1 to 5·0
Stud Boars	1 to 5·0

While the nutritive ratio is undoubtedly a good means of determining whether a ration is suitable, it should only be regarded as a rough guide, for it has been found in experiments that pigs increase in weight more in accordance with the total digestible nutrients than with nutritive ratio.

Total digestible nutrients per day suitable for different classes of stock would be:—

Weaners	1·8 to 2·0 lb.
Stores	2·18 to 2·5 lb.
Fattening Pigs	2·96 to 3·4 lb.
Baconers	3·74 to 4·5 lb.
Sows in Milk	7·2 to 8·4 lb.
Stud Boars	3·2 to 4·1 lb.

The following table shows analyses of samples of various feeding stuffs. These analyses can of course vary quite a lot.

DIGESTIBLE NUTRIENTS PER 100 LB. OF VARIOUS FEEDING STUFFS.

Feed.	Crude Protein.	Carbo-hydrates.	Fat.	Total.
Barley	8·4	67·5	2·0	80·4
Wheat	9·2	67·5	1·5	80·1
Maize	7·0	65·5	3·5	82·4
Sorghum	8·7	66·2	2·2	79·9
Oats	9·6	49·5	4·1	68·3
Peas	19·0	55·8	0·6	76·2
Millet	8·4	63·7	2·4	77·5
Beans	18·8	51·3	0·8	71·9
Rice	6·2	69·7	1·7	73·1
Canary Seed	11·5	48·7	4·3	71·0
Pumpkins	1·1	4·5	0·5	6·7
Artichokes	1·0	14·6	0·1	15·8
Arrowroot	0·1	18·5	..	18·5
Cassava	0·6	26·4	0·2	27·4
Sweet Potatoes	0·9	24·2	0·3	25·8
Potatoes	1·1	15·8	0·1	17·1
Mangolds	0·8	6·4	0·1	7·4
Melons	0·5	3·9	0·2	4·8
Molasses	1·0	58·5	..	59·5
Separated Milk	3·6	5·1	0·2	9·1
Meatmeal	56·2	..	7·2	71·4
Blood Meal	67·0	..	1·3	71·0
Fish Meal	40·1	..	8·3	58·8
Pollard	13·4	46·2	4·3	69·3
Bran	12·5	41·6	3·0	60·9
Linseed Meal	31·7	37·9	2·8	75·9
Peanut Meal	40·3	22·5	9·2	83·5
Peanuts with shell	17·9	8·2	32·6	99·4
Soybeans	33·2	24·7	16·1	94·1
Cottonseed Meal	31·6	25·6	7·8	74·8
Green Lucerne	3·3	10·4	0·4	14·6
Sugarcane	0·4	12·3	0·6	14·1
Green Rape	2·6	10·0	0·3	13·3
Green Maize	0·8	9·9	0·3	11·4
Lucerne Hay	10·6	39·0	0·9	51·6
Oaten Chaff	2·2	34·3	1·2	39·2
Wheaten Chaff	1·1	25·7	0·6	28·2
Bracken Fern Root	7·9	54·0	0·5	62·5

Some Definitions.

Ration is the quantity of food given to one animal for 24 hours, whether given in one or more feeds.

Balanced Ration is the total quantity of food containing the various digestible nutrients in the correct proportions for a given animal for 24 hours.

Maintenance Ration is the quantity of food required by an animal for body maintenance in 24 hours.

Digestible Nutrients is that portion of the crude nutrients which can be assimilated by an animal.

Protein is the term used to denote those nitrogenous compounds used chiefly for growth, flesh development, milk production and reproduction in animals.

Carbohydrates include starches and sugars, comprise the greater part of grains, and besides being used for production of heat and energy, are the main source of fat in the carcase.

Fats can influence the type of fat produced in the carcase. Soft fats or fats of low melting point are generally to be found in grains of such crops as peanuts, soybeans and linseed; on the other hand, fats of animal origin, such as fat in meatmeal, are comparatively hard or of high melting point, and do not affect the quality of the carcase.

Fibre: For maximum growth rates and efficient use of feed, pig rations should not contain a high proportion of fibre. Therefore bulky feeds, such as chaff, hay, silage, &c., should not constitute too great a part of the ration.

Minerals are necessary for normal growth and building up of harder tissues of the body, such as bone. Insufficiency of calcium, iron and phosphorus in the ration will lead to serious trouble and setbacks in growth.

Palatability denotes that foods are pleasing to the taste of animals; it is affected not only by the actual composition and condition of the food, but by the custom of the animals which are being fed.

Assimilation refers to absorption into the system of digestible constituents of foodstuffs.

PREPARATION OF FEEDS.

Most feeds require little preparation for pigs. Maize may be fed shelled or on the cob; it is not materially improved by grinding. Coarsely grinding or cracking small grains, on the other hand, results in a saving of feed. The extent to which a saving can be made by this operation depends somewhat on the hardness of the grain, but primarily on the method of feeding. Because of the pig's habit of rapid eating when hand fed in groups, a large number of small hard grains escape being broken by the teeth, and pass through the body unutilized. Pigs accustomed to eating from a self-feeder eat more slowly and masticate their food more completely than do hand-fed pigs.

Soaking is a poor substitute for grinding small grains, and does not improve the value of maize or cracked grains.

Cooking reduces rather than increases the value of most foods for pigs, hotel and slaughter-house refuse, also English potatoes, being the exceptions. A slight benefit may result by feeding a warm swill in very cold weather. Slopping or swill feeding is an old practice, but tests have not justified its use when fattening pigs, and there is very little evidence to show that it is necessary even with brood sows.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 30th MARCH, 1953.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Hillcrest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White	O. H. Horton, Mannuem, Kingaroy
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Sherman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	G. J. Cooper, " Cedar Glen," Yarraman
	J. B. Dunlop, Acacia road, Kuraby
	A. Curd, Box 35, Jandowae
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

ANIMAL HEALTH

NOTES ON LIVESTOCK PEST CONTROL.

Contributed by the Division of Animal Industry.

At recent meetings of the Animal Industry Committee of the United Graziers' Association of Queensland, several questions relating to the health of livestock were raised. These are given here, with comment by the Division of Animal Industry.

Tick Fever Vaccine.

"That efforts be made to evolve a redwater vaccine which will give immunity, with one inoculation, for a long period—for life if possible."

Tick-fever or redwater immunization is effected by introducing blood containing living virulent tick-fever organisms into the animal's body. The animal then develops a typical attack of tick fever which may vary in severity depending on age, condition and type of the animal, but this attack may be controlled by drug treatment. After the attack subsides, the tick-fever organisms remain in the animal's system in a dormant state for a varying time, which may be from three to 12 months or even longer, and the immunity to tick fever continues during this period. There is a general tendency, however, on the part of the body defences to eliminate the parasitic tick-fever organisms, and some time after this process has been completed the body defences relax and lose their power of controlling the tick-fever organisms. The animal then again becomes susceptible to tick fever.

This state of balance between the host and the parasite is maintained in nature by constant re-infestation by means of ticks and artificially by regular inoculations at intervals of six to 12 months.

The period of immunity following inoculation depends on the continuous presence of tick-fever organisms within the animal's body, and any action to prolong this immunity (such as by weakening the body defences) may result in a relapse to an acute attack of tick fever, together with a greater risk at the time of inoculation.

Contagious Pleuro-pneumonia Vaccine.

"That an endeavour be made to obtain information relating to the stability of pleuro inoculation with cultivated virus."

The pleuro-pneumonia vaccine contains the living organism and is therefore somewhat unstable, but before it leaves the laboratory, tests ensure that enough organisms will remain alive in the field for two months after the date of its manufacture. All users should, therefore, be guided by the expiry date which is placed on every bottle of vaccine which is sold. Practices such as leaving unopened bottles lying in the sun and re-stoppering opened bottles and storing them for future use reduce the "life" of the vaccine and should be rigidly avoided. Although not absolutely necessary, the vaccine should be stored in a refrigerator, especially in tropical areas.

Resistance is established in susceptible animals 5-7 days after vaccination and persists for three years. It appears that young calves do not react to vaccination and some authorities in Australia hold that it is of doubtful value to vaccinate calves under 6-8 months old.

Recent laboratory tests have shown that the vaccine is 97% efficient. However, the results of recent field investigations indicate that better results are obtained in actual practice, and the number of cases which can be attributed to the actual failure of the vaccine is less than 1%.

Serious outbreaks sometimes occur in the field among vaccinated cattle. Recent enquiries have shown that a number of factors contribute to this. These include the following:—

(1) Many animals become infected before they are vaccinated, and as vaccination has no effect on the course of the disease, these animals are liable to become clinical cases any time up to three months after vaccination.

(2) Many animals are often missed when vaccination is carried out.

(3) Careless handling of the seton needle, syringe or vaccine is also a cause. The potency of the vaccine may be reduced to negligible proportions by leaving soaked setons to dry out before use, or by allowing a bottle of vaccine to lie exposed to sunlight for a few hours.

(4) Odd instances occur where the vaccine apparently fails to induce resistance. As stated earlier, these amount to less than 1%.

Blackleg Vaccine.

"That intensified research be undertaken in the control of blackleg."

The control of blackleg in Queensland is undertaken by field officers of the Department of Agriculture and Stock working in co-operation with the Director of Research and officers of the Animal Health Stations, Yeerongpilly and Oonoonba.

Field outbreaks are investigated and all relevant information concerning incidence, age and type of animal affected, method of inoculation and when carried out, etc., is obtained. This information, together with suitable specimens, is submitted to the Animal Health Station, where the organism responsible for the outbreak is isolated and closely studied. When this work is completed, a culture of the organism, together with the history of the case, is supplied to the Commonwealth Serum Laboratories, Melbourne, where several officers are engaged in preparing and testing vaccines for blackleg control.

The organisms isolated from field outbreaks are utilized in the preparation of vaccines which are tested in the laboratory on small animals and sheep. The resistance to blackleg in the vaccinated and unvaccinated control animals is challenged by the inoculation of a potent blackleg material in order to obtain information on the value of the vaccine and the degree of resistance to artificial infection in vaccinated and unvaccinated animals. Tests of this nature were recently carried out with the new C.S.L. vaccine in Melbourne and a solid degree of resistance was demonstrated in vaccinated animals, whereas most of the unvaccinated animals developed the disease. This work is now being extended, and the Commonwealth Serum Laboratories employ an officer to undertake field investigations in vaccinated cattle and sheep in Victoria. The work would have been extended to Queensland if sufficient cases had been available in the autumn and winter of 1952.

A limited number of cases of what appeared to be blackleg have been recorded in animals vaccinated with the new C.S.L. vaccine, but the recognised blackleg organism (*Clostridium chauvoei*) has not been isolated from a vaccinated animal, with possibly one exception in Queensland.

Investigations are being continued, but definite information on the value of the vaccine under field conditions cannot be obtained until another severe outbreak of the disease is encountered.

Cattle Tick Control.

"That as DDT and BHC are incapable of controlling the tick in North Queensland, and as all known insecticides appear to have in time proved that an immunity can be built up, C.S.I.R.O. and the Department of Agriculture and Stock be asked to conduct research into the possibility of controlling the cattle tick by injection into the blood stream of something adverse to the tick."

Although there is evidence to suggest that BHC-resistant ticks are developing in overseas countries and there is some indication that BHC has failed to control the ticks in isolated instances in Queensland, the general statement that DDT and BHC are or have been incapable of controlling ticks in North Queensland cannot be accepted. The Department of Agriculture and Stock through its officers has had extensive experience with DDT in northern as well as other parts of Queensland and very satisfactory results have been obtained. No information is available that DDT-resistant cattle ticks have been detected in Australia or elsewhere.

It is recognized that certain strains of cattle are more resistant than others to tick infestation, and broadly speaking Zebu hybrids are more resistant than European breeds. It is also recognized that ticks fail to thrive on certain types of country (for example, the dry inland areas and also in certain country within the recognized tick infested zone, such as Croydon, Georgetown and parts of the Charters Towers district). Such areas are of granitic formation and generally speaking not good country, whereas the ticks thrive in the adjoining country of better type. There must be some reason for this difference and the problem is receiving consideration; it has been listed for investigation by C.S.I.R.O. The explanation may be that moisture is retained to a greater extent in country more suitable for tick propagation.

Although a certain amount of preliminary work has been undertaken over a period of years to determine the effects or value of the injection of certain animal substances to produce antibodies to external parasites, and thus create an immunity, the work has not advanced sufficiently to suggest that this method of control may have practical application. A chemical injected into the body to produce and maintain a concentration in the blood lethal to ticks may kill the animal before effective control is obtained.

There is a reason why Zebu type animals are more resistant than European breeds, and if this factor were thoroughly understood and it could be incorporated in the European-type animals without the disadvantages of the Zebu, the desired result might be obtained. This perhaps is a problem in which assistance could be obtained from the geneticist and cattle husbandry specialist.

Control of Blowfly Strike in Sheep.

"What is the present position as regards blowfly control?"

Research.—Research work into the control of blowfly strike in sheep has been organised by the Joint Blowfly Committee. By 1941 practical methods of blowfly control had been developed. These included the use of a co-ordinated programme based on the Mules operation, care in the docking of lambs' tails, a mid-season crutching and jetting with arsenic when necessary. Subsequently the tail strip operation was introduced and the value of DDT in the prevention of body strike and BHC for the treatment of large numbers of struck sheep was demonstrated under field conditions in 1950.

Extension Work on Control Measures.—In 1941 the Australian Wool Board contributed finance for the conduct of schools of instruction to acquaint wool-growers with the control measures which could be used. Seventeen schools were held in the initial series. Over 1,000 owners and pastoral workers were contacted through the schools. Eight more schools were held in 1942, 1943, and 1944 and about 120 demonstrations were held on properties by the two officers devoting their time to this work. This was an important stage in the extension drive, when the value of the recommended method was established under field conditions and leaders in the sheep pastoral industry became familiar with their true worth.

Since 1945 more staff has been available for demonstration work. Up to the end of the last financial year they had undertaken over 1,000 demonstrations of the Mules operation and of tailing methods on Queensland properties.

There are approximately 4,000 properties on which sheep breeding is carried out in Queensland. It is clear, then, that at least one-quarter of the industry has availed itself of assistance through personal contact with Departmental field officers. There has also been some spread of information about the suggested methods from wool-grower to wool-grower, but the reaction of the industry to methods which have proved their worth has not been enthusiastic.

Evaluation of the Work on Blowfly Control.—One decade has now elapsed since the commencement of the campaign to bring information about blowfly control measures to the sheep industry in Queensland. The field officers charged with this responsibility have been untiring in their efforts. Suitable literature is available giving details of the methods which might be employed. The agricultural press has been extremely helpful and co-operative in publicising information. In particular it has recounted the experience of wool-growers who have proved the value of the suggested methods. It would not be true to say the campaign was a failure—it would be equally untrue to say it had been an unqualified success.

As far as can be determined, about half the industry has to date failed to embrace the methods of fly control which have been proved effective by the other half. It is suggested that the U.G.A. might consider methods it could employ in disseminating information held by its members as a result of their experiences in blowfly control.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 30th MARCH, 1953.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus" Stud, Greenmount H. V. Littleton, " Wongalea" Stud, Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Sunny Crest " Stud, Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman W. H. Thompson, " Alfa Vale," Nanango
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain " St. Christopher's " and " Iona " Studs, Brookfield road, Brisbane E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny C. E. R. Duncombe, " Marionville" Ayrshire Stud, Landsborough.
Friesian	C. H. Naumann, " Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount J. F. Lau, " Rosallen " Jersey Stud, Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango F. W. Verrall, " Coleburn," Walloon
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

ASTRONOMICAL DATA FOR QUEENSLAND.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

THE STARS.

The discussion of the constellations visible from Queensland which has appeared in this journal for some time has been completed. While dealing with the constellations it may be of interest to mention something of the stars in general and to dispel some of the false impressions often met with.

Confusion often arises as to the difference between a star and a planet. When observed in the night sky with the naked eye, there appears no difference, except, perhaps, that on some occasions planets such as Venus and Jupiter are much brighter than the other objects. Stars, however, differ from the planets in that the stars are huge, incandescent, gaseous bodies which give out light just as our sun, which is a star, gives off light; whereas the planets belong to a system of relatively cool, solid bodies circulating round our sun and, like the moon, shining because their surfaces reflect the sun's light rays to us.

Though the stars are much larger bodies than the planets, because of their tremendous distance from us, even when viewed in the most powerful telescopes they appear only as a pinpoint of light; but the planets under telescopic magnification give a definite disc image. It is frequently stated that a planet may be distinguished from a star because stars "twinkle" and planets do not, and although theoretically this is correct it cannot be relied upon as a means of identification. The condition is brought about by the passage of the light through uneven densities of atmosphere, which cause erratic bending of the rays. As the light from a star is a point of light, any variation in the direction of the rays reaching us makes the star appear to "dance" or "twinkle." The reflected light from the planets, however, is not a point source, but comes from a disc containing numerous points of light, and while each point of light from the planet's disc may suffer the same fate as the light from the star, all the points on the planet's disc are not affected exactly the same at the same instant and some rays are continually passing to our eyes, thus giving a practically uniform light. However, while the bending of the rays may not cause the planets to "twinkle," it often causes an apparent change of colour. The "twinkling" effect is much more marked when the object is near the horizon.

Planets can also be distinguished from the stars by their changing position in the sky. Because of the comparative nearness of the planets to us, their movement is much more marked than the movement of the stars. So far away are the stars that, though they are moving through space at considerable speeds and in all directions, their movement cannot be detected (except by accurate instruments specially constructed for the purpose) and they appear to be "fixed" in relation to one another. Over thousands of years the constellations have remained the same; for instance Orion, Scorpius, The Pleiades, etc. This "fixed" pattern of the constellations in the sky, then, is useful as a reference to indicate the movement of closer objects such as the planets, meteors and comets. The movement of the closer planets such as Venus and Mars in relation to the stars is most noticeable, and over the last few months watchers of the evening sky will have seen quite a change in the positions of these two planets. The closer the planet is to earth, the more apparent the movement, and the outermost naked-eye planet, Saturn, remains in the same constellation for some considerable time.

Though we speak of the sun and planets as being close to us, they themselves are at great distances from the earth. The sun is 93,000,000 miles from us; while Venus may approach as close as 26,000,000 miles and recede to 160,000,000 miles; Mars may come within 34,600,000 miles and at its maximum distance from the earth be 234,400,000 miles away. The outermost member of our sun's system of planets, Pluto, is on the average 3,666,000,000 miles from us. These distances are great, but are insignificant when compared with the distance from us of the stars, the nearest star being almost 25 million million miles away. Even though we gasp at the mention of this figure, we cannot really comprehend its true value and the vastness of space. The following, however, may give some idea of the relative sizes and distances of these objects. Supposing the sun to be represented by a ball 2 feet in diameter, Venus would be represented by a bead moving round the ball in a circle of 142 feet radius; the earth, also, would be represented by a bead and moving in a circle of 215 feet radius, while Mars and Pluto would be represented by a pin's head, that for Mars moving in a circle of 327 feet radius and for Pluto moving in a circle of 1½ miles radius. On this scale the nearest star would be placed 11,000 miles away.

The brightness of the stars is affected by size, temperature, and distance. A small star which is close to us may appear brighter than a large star much farther away. Our sun, for instance, is extremely bright because of its nearness, but it is really only a small star. The bright star Sirius, which is not much larger than our sun, is about 9 light years away (a light-year is approximately 6 million million miles) and is 26 times brighter than our sun; while Betelgeuse has a diameter over 200 times greater than the sun and is 1,200 times brighter, but this star is 272 light-years away.

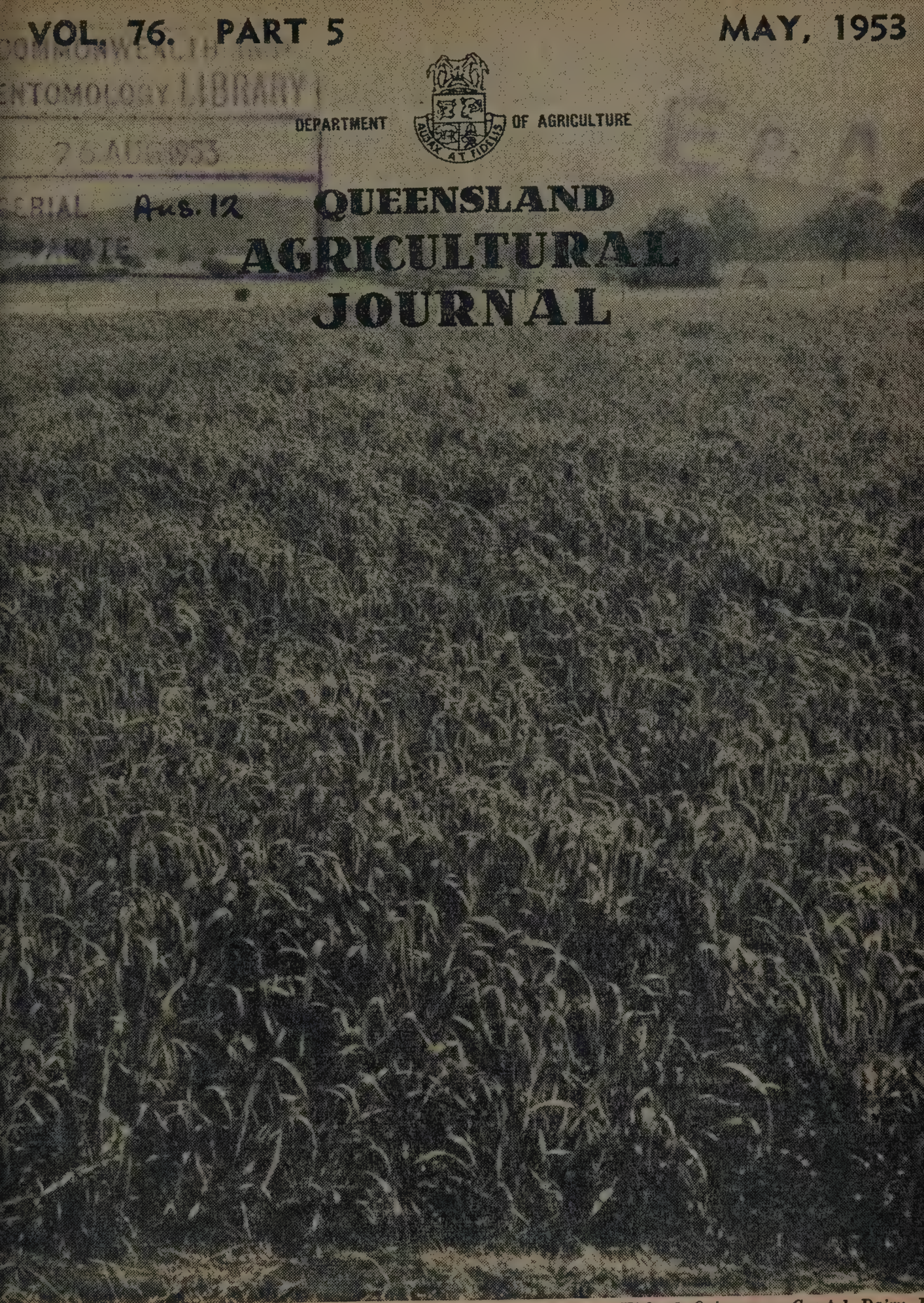
All the bright stars with millions of other smaller ones are contained in an enormous collection of stars called "Our Galaxy," which measures 100,000 light-years in diameter and is 10,000 light-years thick at the centre. The milky way indicates the boundary of the long axis. Beyond "Our Galaxy" exist millions of other galaxies which appear as misty patches called "Spiral" nebulae.

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Maize Fertilizer and Rotation Trials on the Atherton Tableland.

W. J. CARTMILL, Chief Soil Conservationist.

THE Atherton Tableland is part of the Cairns hinterland in North Queensland. Although it is situated in tropical latitudes the elevation of the Tableland gives it a temperate climate. The maize-growing belt is a relatively small part of the Tableland country, covering approximately 30,000 acres in a compact area at the northern end.

The town of Atherton, on the south-western edge of the maize belt, is 2,469 feet above sea-level. The average annual rainfall at Atherton is approximately 54 inches, about three-quarters of which falls during the four summer months of December to March. Although the summer rainfall is fairly reliable, it is subject to considerable variation from year to year. Table 1 shows the average monthly rainfall at Atherton over a 42-year period, and the monthly rainfalls for 1947 to 1951 inclusive, the period over which the trials reported herein were conducted. The variability of the annual as well as the monthly totals is well exemplified in this table.

TABLE 1.

RAINFALL (IN POINTS) AT ATHERTON.

Month.	Average (42 Year Period.)	1947.	1948.	1949.	1950.	1951.
January	1,152	442	1,200	1,475	1,401	1,514
February	1,144	1,239	365	2,588	595	1,164
March	908	1,089	1,107	1,822	1,562	284
April	442	200	319	607	1,005	8
May	234	332	190	265	91	99
June	173	245	325	96	470	130
July	112	79	161	127	262	64
August	84	499	113	201	26	29
September	74	248	0	84	178	426
October	90	257	8	69	126	52
November	260	547	346	582	787	96
December	702	380	640	503	2,389	327
Total	5,375	5,557	4,774	8,419	8,892	4,193

The soils of the Atherton Tableland maize-growing belt are colloquially described as red volcanics for the obvious reasons that they are red in colour and have been derived from basalt. They are deep, well-structured clays, friable and permeable, with a red-brown

surface horizon changing gradually to a bright red in the deep subsoil. They are usually broadly divided into two classes according to whether they carry a vegetation of rain-forest (''scrub'') or of hardwood forest (''forest''), and are referred to locally as scrub and forest soils respectively. The scrub soils are recognised as having a higher inherent fertility than the forest soils, although both classes rank high in productivity.

Maize sowing takes place during the period November–January with the bulk of the sowing being carried out in December, if soil moisture is adequate. Harvesting may begin in May and continue till October, depending on weather conditions.

Maize has been grown on the Tableland for grain production for upwards of 60 years. It has been grown mostly under a system of monoculture and without the use of fertilizers. Yields have been relatively high, the average of 32 bus. per acre being the highest district average in the State. Individual farm yields of 80 bus. or more per acre have been recorded. That good yields have consistently been obtained under such farming practices over a long period is a clear indication of the high productivity of the soils. Until fairly recently, there was a general belief amongst growers on the Tableland that fertilizers were of no benefit, and a number of trials which had been conducted in the past mostly confirmed this opinion. Many of the trials, however, were conducted on the more fertile scrub soil. Recent trials with fertilizers and with green manures indicate that the forest soil responds markedly to these soil amendments, whereas on the scrub soils little or no response is obtained.

A summary of these recent trials, covering investigations into the influences on maize grain yields of fertilizer applications, green manures and crop rotations is presented here.

The fertilizer trials involved mainly investigations of the requirements of the soil for the three major plant foods—nitrogen, phosphorus and potassium. Nitrogen was supplied as sulphate of ammonia, phosphorus as superphosphate, and potassium as sulphate of potash. These are forms in which the particular plant foods are commonly supplied in commercial fertilizer mixtures. In each trial each fertilizer was applied at three levels, as follows:—

Sulphate of ammonia—

Nil	(N_0)
1 cwt. per acre	(N_1)
2 cwt. per acre	(N_2)

Superphosphate—

Nil	(P_0)
2 cwt. per acre	(P_1)
4 cwt. per acre	(P_2)

Sulphate of potash—

Nil	(K_0)
1 cwt. per acre	(K_1)
2 cwt. per acre	(K_2)

All possible combinations of these treatments were applied, making in all 27 different applications. These were:—

$N_0P_0K_0$ (nil)	$N_1P_0K_0$	$N_2P_0K_0$
$N_0P_1K_0$	$N_1P_1K_0$	$N_2P_1K_0$
$N_0P_2K_0$	$N_1P_2K_0$	$N_2P_2K_0$
$N_0P_0K_1$	$N_1P_0K_1$	$N_2P_0K_1$
$N_0P_0K_2$	$N_1P_0K_2$	$N_2P_0K_2$
$N_0P_1K_1$	$N_1P_1K_1$	$N_2P_1K_1$
$N_0P_2K_1$	$N_1P_1K_2$	$N_2P_1K_2$
$N_0P_1K_2$	$N_1P_2K_1$	$N_2P_2K_1$
$N_0P_2K_2$	$N_1P_2K_2$	$N_2P_2K_2$

Data for trials covering five seasons from 1947-48 to 1951-52 are given in the following sections.

FERTILIZER TRIALS ON FOREST SOILS.

Trial No. 1.

Location: Massasso Bros., Mapee. *Season:* 1947-48.

A summary of the results of this trial is given in Table 2. The yield of 25·63 bus. per acre for N_0 is the mean yield of all plots to which no sulphate of ammonia was applied, irrespective of whether they received applications of superphosphate or of potash or of both. Similarly the yield of 37·27 bus. for N_1 is the mean value of all plots treated with 1 cwt. per acre of sulphate of ammonia regardless of what other treatments they received. Other figures are mean values obtained in a similar way.

TABLE 2.

Summary of Results (Mean Values)—Trial No. 1.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	25·63	34·6
N_1	37·27	22·7
N_2	47·80	19·4
P_0	32·31	30·5
P_1	39·02	23·7
P_2	39·37	22·5
K_0	35·84	26·9
K_1	35·66	28·0
K_2	39·20	21·8
Significant differences ..	N_1 greater than N_0 N_2 greater than N_1 and N_0 P_1 greater than P_0 P_2 greater than P_0	N_1 and N_2 less than N_0 P_1 and P_2 less than P_0

The increased yield for an application of 1 cwt. of sulphate of ammonia per acre amounted to 11·64 bus. per acre, and for 2 cwt. of sulphate of ammonia the increase was 22·17 bus. Superphosphate at 2 cwt. per acre increased the yield by 6·71 bus. per acre. The potash fertilizer had no effect on yields. There was no interaction effect

between nitrogen and phosphorus in this trial; in other words, the responses to nitrogen and phosphorus were independent of one another. An application, therefore, of 2 cwt. of sulphate of ammonia and 2 cwt.

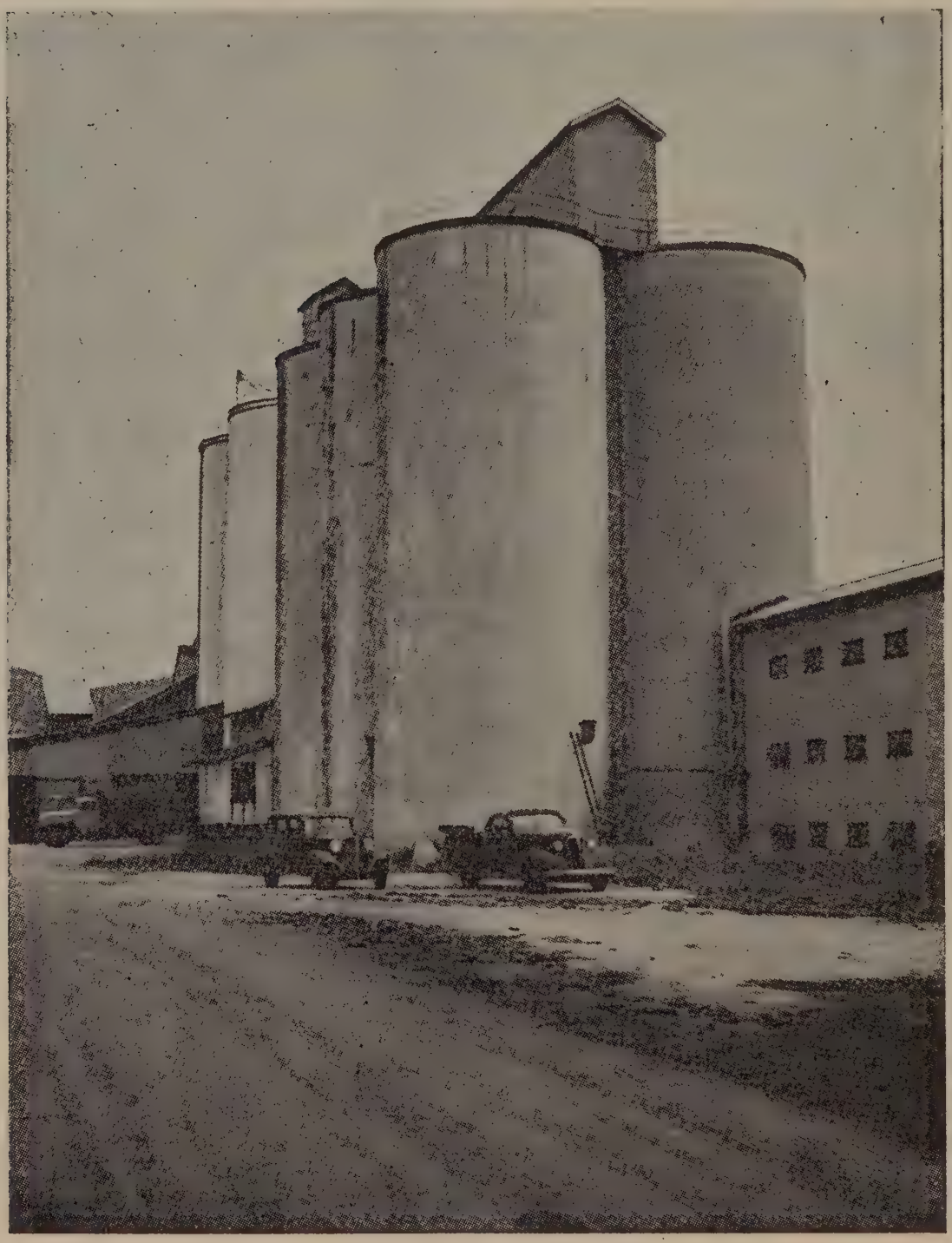


Plate 1.

The Atherton Tableland Maize Marketing Board's Silos at Atherton.

of superphosphate per acre increased the yield by 28·88 bus. per acre, and thereby more than doubled the yield of grain. The fertilizer dressings also considerably reduced the percentage of barren stalks in the crop, as is indicated in the table.

In this trial a mean of 13·4% of cobs was affected by disease (cob rots); there were no significant differences between plots in this respect. The shelling percentage was relatively high at 83·7.

Trial No. 2.

Location: Massasso Bros., Mapee. *Season:* 1948-49.

The results of this trial are summarized in Table 3.

TABLE 3.

Summary of Results (Mean Values)—Trial No. 2.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	27·37	22·8
N_1	30·79	20·3
N_2	37·07	14·5
P_0	31·92	19·0
P_1	30·90	19·5
P_2	32·41	19·2
K_0	31·55	19·7
K_1	30·99	21·8
K_2	32·69	16·1
Significant differences ..	N_2 greater than N_0 N_2 greater than N_1	N_2 less than N_0 N_2 less than N_1

There was a response to nitrogen only. The response to 1 cwt. of sulphate of ammonia per acre was only slight, but it was marked at the 2 cwt. level. It is interesting to note that on the same farm in the previous season a more marked response to nitrogen and a response to phosphorus was obtained.

The different responses are probably due to different seasonal conditions. The 1947-48 season was preceded by a wet spring, 1,551 points being recorded at Atherton for the 4-month period August-November; whereas for the corresponding period before the 1948-49 season only 467 points were recorded. When a wet period precedes the planting period a deficiency of available nitrogen (nitrates) in the soil is created because of leaching effects, and nitrogenous fertilizers are required to correct the deficiency. Conversely, when a moderately dry period precedes the planting period, soil nitrates accumulate and a deficiency of available nitrogen is either slight or non-existent. The different responses to phosphorus are explained by the contrasting rainfalls during the respective growing periods. For the 6-month period December-May in the 1947-48 season, 3,561 points were recorded at Atherton, and for the corresponding period in 1948-49 the recording was 7,397 points. The wetter period is conducive to a more ready uptake of phosphorus from the soil by the crop.

As well as increasing the yield, the heavier application of sulphate of ammonia greatly reduced the number of barren plants.

Trial No. 3.

Location: Massasso Bros., Mapee. *Season:* 1949-50.

As shown in Table 4, sulphate of ammonia again considerably increased the yield, particularly when applied at the higher level of 2 cwt. per acre. Neither phosphatic nor potassic fertilizers had any significant effect on yield. Sulphate of ammonia also greatly reduced the percentage of barren plants, as before.

TABLE 4.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 3.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	27·80	20·1
N_1	36·71	8·3
N_2	43·92	10·0
P_0	35·23	15·2
P_2	38·35	10·8
P_2	34·84	12·3
K_0	36·10	13·2
K_1	35·49	14·4
K_2	36·84	10·6
Significant differences ..	N_1 greater than N_0 N_2 greater than N_1	N_1 less than N_0 N_2 less than N_0

Trial No. 4—Residual Fertilizer Trial.

Location: Massasso Bros., Mapee. *Seasons:* 1948-49 and 1949-50.

Following the good responses to nitrogen and to phosphorus obtained on the forest soil at Massasso Bros. in the 1947-48 season and the response to nitrogen in the 1948-49 season, it was decided to replant the sites of the plots with maize in the 1948-49 and 1949-50 seasons respectively to observe if the beneficial effects of the fertilizer would extend into the second season. The sites of the original plots were easily located from datum pegs, and the rows were placed to coincide with the positions of the original rows. The results are shown in Table 5.

TABLE 5.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 4.

Treatment.	Shelled Grain (bus./ac.)		Percentage of Barren Stalks.	
	1948–49.	1949–50.	1948–49.	1949–50.
N_0	20·59	30·61	29·2	12·4
N_1	19·31	29·35	30·2	19·6
N_2	23·43	33·05	22·1	19·2
P_0	21·86	33·15	23·6	12·4
P_1	21·96	29·89	25·9	21·2
P_2	19·51	29·97	31·9	17·5
K_0	20·78	28·09	27·9	23·2
K_1	21·66	32·86	27·8	14·2
K_2	20·88	32·06	25·8	13·8

There were no significant differences in yield due to fertilizer treatments of the previous season in either of the two trials, which indicates that there was no carry-over effect of fertilizer from one season to the next.

FERTILIZER TRIALS ON SCRUB SOILS.

Trial No. 5.

Location: Kairi Regional Experiment Station. *Season:* 1948-49.

The results of this trial are shown in Table 6.

There was no response to fertilizer on this soil. While responses are usually not obtained on the scrub soils of the maize belt, this particular soil at Kairi has probably a higher than average fertility. It has been cultivated only since 1940 and was heavily fertilized for a few years subsequently, when the farm was used by the Army for the production of vegetables.

TABLE 6.

SUMMARY OF RESULTS

(MEAN VALUES)—TRIAL NO. 5.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	59·27	10·3
N_1	57·90	13·4
N_2	58·80	11·2
P_0	59·05	12·5
P_1	58·63	11·8
P_2	58·29	10·6
K_0	58·68	11·8
K_1	58·25	11·0
K_2	59·04	12·1

Trial No. 6.

Location: J. A. & J. H. Bravery, Tolga. *Season:* 1950-51.

Although, as stated previously, responses to fertilizer are not usually obtained on the scrub soils, it is found that in cases where the fertile topsoil has been eroded fertilizers are beneficial. This experiment was conducted to determine the plant food requirements of a typical eroded area of scrub soil.

Table 7 shows that there was a marked response to sulphate of ammonia applied at 1 cwt. per acre. The further response when double this amount of fertilizer was applied was small and non-significant. Phosphatic and potassic fertilizers were of no benefit. The yield figures in this trial showed some variations which are difficult to explain, especially in relation to phosphate, but they are probably due to extreme soil variability, since the area has suffered severely from gully and rill erosion.

The low yield figures are a reflection of the low productivity of this eroded area. Nearly half the plants did not produce cobs, as is indicated in the table.

The restoration of the productivity of areas such as this requires more than the mere application of fertilizers. An improvement in the physical condition of the soil is an essential prerequisite, and is best achieved by putting the area under a pasture ley for a year or two.

TABLE 7.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 6.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	17·49	58·6
N_1	27·04	41·4
N_2	29·14	38·2
P_0	26·07	42·5
P_1	21·78	50·9
P_2	25·83	44·8
K_0	25·88	45·6
K_1	23·00	49·6
K_2	24·80	43·0
Significant differences ..	N_1 and N_2 greater than N_0 P_0 and P_2 greater than P_1 K_0 greater than K_1	N_1 and N_2 less than N_0 P_0 less than P_1 K_2 less than K_1



Plate 2.

A Maize Fertilizer Trial on the Farm of Massasso Bros., Mapee, in 1950. The centre row, which has been broken down, was sown for the purpose of separating plots receiving different fertilizer treatments.

PHOSPHATE TRIAL ON FOREST SOIL.

Trial No. 7.

Location: A. Brown, Tolga. *Season:* 1949-50.

This trial was designed to test the relative values of various phosphatic fertilizers on the red loams of the Atherton Tableland. These soils, in common with all soils of the same type, have the property of rendering soluble phosphates such as superphosphate relatively unavailable to plants in a short period of time. It was desired to determine whether other less soluble phosphates would give better results than superphosphate. Sulphate of ammonia was also used in half of the plots because of the possibility that the phosphates might perform better in the presence of nitrogen.

The following treatments were used:

A. Superphosphate 336 lb./acre (=78 lb. phosphoric acid as P_2O_5).

B. Serpentine superphosphate 457 lb./acre (=78 lb. phosphoric acid as P_2O_5).

C. Basic superphosphate 386 lb./acre (=78 lb. phosphoric acid as P_2O_5).

D. Rock phosphate 205 lb./acre (=78 lb. phosphoric acid as P_2O_5).

E. No phosphate.

X. Sulphate of ammonia 112 lb./acre.

Y. No sulphate of ammonia.

The results (Table 8) give a rather confused picture of the effect of the various phosphates on yield. Without sulphate of ammonia, serpentine superphosphate was the only phosphate that effected much improvement in yield. With sulphate of ammonia, however, all the phosphatic fertilizers caused an increase in yield, more particularly superphosphate and basic superphosphate. Sulphate of ammonia alone was ineffective but it increased the yields appreciably when applied with the phosphates other than serpentine superphosphate.

TABLE 8.

RESULTS (MEAN VALUES)—TRIAL NO. 7.

Treatment.	Shelled Grain (bus./ac.)	
	Without Sulphate of Ammonia (Y).	With Sulphate of Ammonia (X).
A. Superphosphate	43·91	53·15
B. Serpentine superphosphate	50·96	49·26
C. Basic superphosphate ..	40·41	55·35
D. Rock phosphate	36·07	49·21
E. No phosphate	41·26	41·32
Significant differences ..	B greater than D B greater than C	C greater than E A greater than E
	X greater than Y with A, C, and D X greater than Y on mean values	

CONCLUSIONS AND RECOMMENDATIONS ON FERTILIZERS.

This series of fertilizer trials leads to the conclusion that the *forest soils* on the Atherton Tableland will respond markedly to applications of certain fertilizers, but the *normal scrub soils* will not. Scrub soils that have been eroded will also respond to fertilizer applications but cannot be restored to full productivity by this means alone.

The plant food which is found to be most deficient in the *forest soils* is nitrogen. This is indicated by the marked responses obtained to applications of sulphate of ammonia in all trials on that soil type. Satisfactory responses are sometimes obtained also to phosphorus, applied as superphosphate, on the forest soils. The degree of responses to nitrogen and phosphorus seems to bear some relationship to the seasonal conditions which prevail during the spring and summer months. The greatest response to nitrogen occurs following a wet spring and early summer. The relationship between phosphorus response and seasonal conditions is not so definite, but it seems that phosphatic applications are beneficial on forest soil in all but exceptionally wet seasons. There is also evidence from one trial to support the suggestion that on some areas of forest soil an interaction between nitrogen and phosphorus occurs, whereby each of these plant foods is only beneficial when applied with the other.

The potassium status of the soils is apparently satisfactory, since potassic fertilizers give no response.

The nitrogen requirements of the soils could largely be met by a rotational cropping system in which a leguminous green manure precedes the maize crop. Under the monoculture system normally used on the Tableland, however, this is not practicable, and nitrogen requirements must be supplied through artificial fertilizers. Phosphatic fertilizers must be used in any case to supply the phosphorus requirements.

On the basis of results obtained in this series of trials, it is recommended that for forest soils of the Atherton Tableland "maize belt" a fertilizer mixture containing equal parts by weight of sulphate of ammonia and superphosphate be applied at the rate of about 4 cwt. per acre. This treatment can be expected to increase the yields by 10-25 bus. per acre, according to the season. The fertilizer should be applied in the drill at sowing time. Care should be taken to ensure that it is either covered by or mixed with soil so that seed does not come in direct contact with it and thereby have the germination impaired.

It is recommended that *eroded scrub soils* be fertilized as for forest soils. Full productivity of eroded soils, however, cannot be restored until their organic matter status has been improved and this can most readily be achieved by putting them under a pasture ley for a year or two.

Normal scrub soils in the maize belt have not been found to respond to applications of fertilizer.

It is considered that when a protracted period of wet weather follows the maize sowing, it would be advantageous to side-dress the crop with sulphate of ammonia at the rate of about 1 cwt. per acre.

The reason for this recommendation is that the soluble nitrogen compounds in the soil, derived either from added fertilizer or from natural sources, are readily leached from the topsoil by water and

consequently copious rains early in the season might well cause the crop to suffer from a deficiency of nitrogen with resultant low yields of grain. Under such conditions a side-dressing of sulphate of ammonia at the last cultivation period would replenish the nitrogen supplies within the root zone at a time when the crop's requirements of this plant food are high.

GREEN MANURE–MAIZE ROTATION TRIALS.

Previous investigations have shown that maize crops on the Atherton Tableland respond to green manures ploughed in some 6–8 months prior to the maize planting. The degree of response is variable, being mostly of the order of 25 per cent. increase in grain yield. In these trials, responses were not obtained beyond the first season following the green manure. It would appear from these investigations that green manuring is not an economical practice for Tableland maize soils, since the increase in yield following the green manure does not compensate for the loss of a season's crop.

It has been pointed out, however, that the influence of seasonal conditions may have an important bearing on the degree of response obtained, which, apparently, is most marked in dry seasons. It is possible also that the number of seasons over which the beneficial effects of a green manure may last may likewise be influenced by seasonal conditions. Furthermore, the ploughing under of a green manure as soon as the crop matures or earlier, which allows a fairly long period to elapse before the following-on maize crop is planted, may not be as advantageous in preserving the benefits of the green manure for the maize crop as one which allows the legume to remain as a mulch on the surface of the soil until the land is ploughed preparatory to planting the maize. To observe the effects of different seasons on both the degree and the period of response, two long-range trials were set out in 1947. They were planned to run for four years or longer and to include the following rotations.

(1) Maize grown continuously.

(2) Green manure for one season followed by maize the next season.

(3) Green manure for one season followed by maize for next two seasons.

(4) Green manure for one season followed by maize for next three seasons.

The trials were designed so that comparisons of maize continuously and maize following the green manure could be made each year after the first by including five treatments as follows:

Treatment.	1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.
a	M	M	M	M	M
b	G	M	M	M	G
c	M	G	M	M	M
d	M	M	G	M	M
e	M	M	M	G	M

G = Green Manure ; M = Maize.

The green manure used was velvet bean and it was ploughed under each year when the land was prepared for the next season's maize crop. No fertilizer was applied.

The trial was established on each of the forest and scrub soil types.

Trial No. 8—Forest Soil.

Location: Massasso Bros., Mapee.

From the results of the trial on the forest soil (Table 9) it is clear that in each of the three seasons the green manure caused a marked improvement in yield in the following maize crop based on a comparison with the continuous maize plots. The increases were respectively 60 per cent., 58 per cent., and 105 per cent. There is some evidence that the benefit of the green manure extended into the second following maize crop in the 1950-51 season, but the increased yield in this instance is not significant. There is no evidence of any carry-over effect to the third year for the only season for which third-year data are available.

TABLE 9.

SUMMARY OF RESULTS (MEAN VALUES) OF GREEN MANURE-MAIZE ROTATION TRIAL ON FOREST SOIL.

Season.	Treatment.	Yield (bus./ac.)	Percentage of Barren Stalks.
1947–48	1. Maize each year	24·80	34·60
1948–49	1. Maize each year	22·15	29·18
	2. 1st year after green manure..	35·62	16·25
		(2 sign. greater than 1)	(2 sign. less than 1)
1949–50	1. Maize each year	32·02	13·9
	2. 1st year after green manure ..	50·62	6·9
	3. 2nd year after green manure..	33·86	11·7
		(2 sign. greater than 1 and 3)	(2 sign. less than 1)
1950–51	1. Maize each year	19·20	70·13
	2. 1st year after green manure ..	39·30	25·13
	3. 2nd year after green manure..	23·40	57·54
	4. 3rd year after green manure ..	19·40	64·49
		(2 sign. greater than 1, 3, 4)	(2 sign. less than 1, 3, 4)

To assess the economic value of the rotation, it is necessary to examine the yields obtained over the various periods of the rotation and compare them with those for the same periods from the continuous maize treatment.

From the table above it is readily seen that for a 2-year rotation of maize-maize v. green manure-maize, three comparisons are possible; for a 3-year rotation (maize-maize-maize v. green manure-maize-maize)

there are two comparisons; and for a 4-year rotation there is one comparison. These are tabulated as follows:—

2-YEAR ROTATION.

Total Yields (bus./ac.).	
Maize-Maize.	Green Manure-Maize.
46·95	35·62
54·15	50·62
51·22	39·30

3-YEAR ROTATION.

Total Yields (bus./ac.).	
Maize-Maize-Maize.	Green Manure-Maize-Maize.
78·97	69·48
73·37	74·02

4-YEAR ROTATION.

Total Yields (bus./ac.).	
Maize-Maize-Maize-Maize.	Green Manure-Maize-Maize-Maize.
98·17	88·88

From these figures it is doubtful if any of the green manure rotations could be justified on economic grounds. Further experimentation would be required to prove this point definitely. On the data available, the 3-year rotation appears the most promising. For one 3-year period, two maize crops following the green manure gave a slightly better total yield than three successive maize crops over the same period.

In assessing the economic value of the rotations, consideration must be given to the saving of the costs of production of one maize crop, although this is offset to some extent by the expenses associated with the production of the green manure crop. The difference between these costs would probably leave a balance in favour of the rotation.

Trial No. 9—Scrub Soil.

Location: Kairi Regional Experiment Station.

The results shown in Table 10 indicate that the green manure improves the yield of the following maize crop in the scrub soil in some years but not in others. The improvement was most pronounced in 1949-50 and in 1950-51 The 1951-52 results are not good criteria of the value of the rotation because the stand of velvet beans in the preceding season was poor and the stand of maize in the same season was likewise unsatisfactory. Furthermore, this soil had not been cropped with maize for a long succession of years prior to commencing

this experiment and consequently was in a highly productive condition at the start. It is probable that continued cropping to maize would exhaust the fertility of the soil to a point where the green manure would have pronounced beneficial effects. Such effects are strongly suggested from the results of the 1949-50 and 1950-51 seasons already referred to. In the former season, the value of the green manure was still evident in the second maize crop.

TABLE 10.

SUMMARY OF RESULTS (MEAN VALUES) OF GREEN MANURE-MAIZE ROTATION TRIAL ON SCRUB SOIL.

Season.	Treatment.	Yield (bus./ac.)	Percentage of Barren Stalks.
1947–48	Maize each year	44·30	15·90
1948–49	Maize each year	65·67	17·51
	1st year after green manure ..	69·56	16·78
1949–50	Maize each year	50·92	11·80
	1st year after green manure ..	64·27	9·50
	2nd year after green manure ..	58·66	13·60
1950–51	Maize each year	32·10	19·38
	1st year after green manure ..	46·80	20·32
	2nd year after green manure ..	33·30	20·61
	3rd year after green manure.. ..	38·20	18·98
1951–52	Maize each year	61·1	13·80
	1st year after green manure ..	63·7	13·10
	2nd year after green manure ..	60·3	18·10
	3rd year after green manure.. ..	64·6	12·40



Plate 3.

Mechanical Harvesting of Maize on the Atherton Tableland.

From an economic aspect the rotation has not been beneficial. The improved yields following the green manure have in no case compensated for the loss of a season's crop. Although the information so

far obtained from this experiment is inconclusive, it seems improbable that this particular rotation would prove economically acceptable on the fertile scrub soils.

PEANUTS-MAIZE ROTATION TRIAL.

Although a systematic rotation of crops is not a general practice on the Atherton Tableland, it frequently happens that maize is planted on areas which grew peanuts in the previous season. Opinions differ among growers concerning the effect of the peanut crop on the following maize crop, some claiming that the yield of maize is depressed and others that it is improved.

To test the effect over a number of seasons under experimental conditions, a trial was started on the farm of A. Brown, at Tolga, in 1946 and planned to run for four years. It was designed so that comparisons of maize following peanuts against maize continuously could be made each year after the first—that is, in each of three successive seasons. The results are given in Table 11.

TABLE 11.

SUMMARY OF RESULTS (MEAN VALUES) OF PEANUT-MAIZE ROTATION TRIAL ON FOREST SOIL.

Season.	Mean Yields Shelled Grain (bus./ac.)		Percentage of Barren Plants.		Yield of Peanuts (lb./ac.)
	Maize following Maize.	Maize following Peanuts.	Maize following Maize.	Maize following Peanuts.	
1946–47 ..	23·4	..	..	..	886·1
1947–48 ..	26·1	36·7 (Sign. increase)	10·70	4·40 (Sign. lower)	1,042·0
1948–49 ..	23·82	31·4 (Sign. increase)	30·82	23·26 (Sign. lower)	350·3
1949–50 ..	28·96	36·20 (Increase not sign.)	19·60	11·80 (Sign. lower)	1,044·0

Maize following peanuts has consistently yielded substantially higher than maize following maize in each of three seasons for which such data are available. For the 1947-48 season this increase was about 40%; for the 1948-49 season it was about 32%; and for the 1949-50 season, following a light crop of peanuts, it was 25%.

On the basis of these results it would appear that the inclusion of peanut crops in the maize cropping programme would have a beneficial result on maize yields in forest soils.

A Self-Feeding Haystack.

Mr. William Beak, of the Central District, draws attention to a self-feeding haystack that he states has proved very useful on cattle-raising properties in Central Queensland.

Bush hay is harvested and carted to selected parts of the paddocks, where it is stacked and salted in frameworks of bush timber at which stock can feed themselves.

The frames are built on ground which has been built up about a foot to ensure drainage. Each is 21 ft. long by 18 ft. wide and 7 ft. high. The six posts are sunk 3 ft. into the ground. Along the 21 ft. sides, saplings spaced 3 ft. 6 in. apart are spiked to the top plates and slant to the centre of the frame, where the ends are driven 4 in. into the ground. The ends of the frame should be closed.

The hay can be built up to a height of about 10 ft. above the frame, but it should not overlap the top plates, as this prevents automatic lowering of the stack as the hay is eaten from between the slanting saplings. The stack is provided with a weatherproof cap of a suitable material—self-thatch, bark, galvanized iron, &c.

Stock may be given free access to the stacks or the stacks may be fenced off and made available as required. It is stated that salted bush hay held in these stacks has remained in good condition for at least four years.

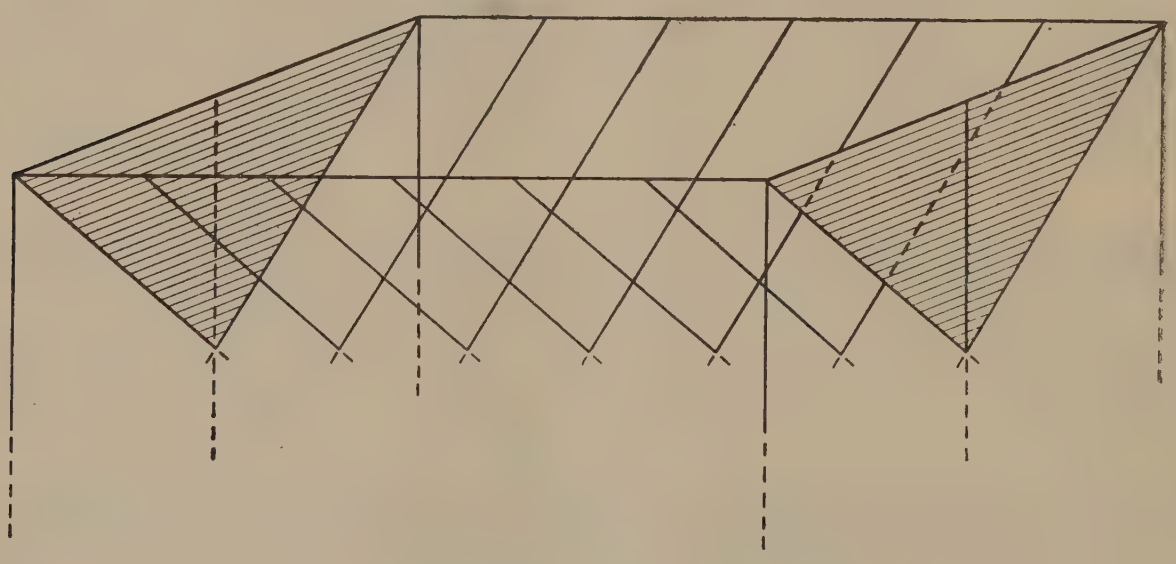


Plate 1.

Diagram of a Self-feeding Haystack.



Tomato, Cape Gooseberry, Egg Plant and Capsicums.

BY OFFICERS OF THE HORTICULTURE BRANCH.

THE tomato, cape gooseberry, egg plant and capsicums or peppers all belong to the same botanical family, the *Solanaceae*, and are known as solanaceous crops. They are herbaceous plants grown as annuals for their fruit, and somewhat similar cultural methods are employed for them all. They are grown from seed, usually in specially prepared beds or boxes, and transplanted to the field.

SEEDBEDS.

The production of sturdy, vigorous seedlings is essential. Virgin ground is preferred for the seedbeds; if it is not available, land which has previously grown solanaceous crops may be used, but sterilizing with formalin or by a surface fire before planting is usually advisable. The site selected for the seedbed should receive the maximum amount of morning sun and adequate protection from heavy winds.

Preparation.

Raised beds approximately 4–6 in. high and 4 ft. wide ensure good drainage and give ample depth of soil for root development (Plate 1).

The seedbeds should be well dug to spade depth and brought to a fine tilth. During the preparation of the bed, a small quantity of fertilizer or well-rotted stable manure may be added to the soil. A sufficient application for the average soil is a handful (about 3 oz.) of blood and bone or one of the recognised vegetable fertilizers to the square yard. The beds should be completed by levelling, raking and watering about two weeks before the seed is sown. Watering consolidates the soil and germinates weeds, which can then be destroyed just prior to sowing.

If plants are raised during cool weather, cold-frames may be used to hasten the germination of the seed and the growth of the seedlings.

Planting the Seed.

The seed is sown in shallow drills about 4–6 in. apart and about ¼ in. deep. After covering the seed with soil, the bed should be gently firmed with a flat board and lightly watered. If a light mulch is placed



Plate 1.

Tomato Seedlings Raised in the Open in a Hilled Bed. The bed on the left has been prepared for later sowing.

over the bed, further watering will not be needed until the seeds have germinated. Well-rotted manure and clean sawdust are good mulching materials. Old bags are often used for this purpose, but they must be removed immediately the plants appear above the ground. Seedbed covers are needed in some areas to protect the seedlings from heavy rain.

About 1–1½ oz. of seed should be sown for each acre to be planted. This rate of sowing will provide a surplus of plants from which the best can be selected for transplanting into the field.

Tomato seedlings can advantageously be raised individually in small containers, such as iron cylinders (Plate 2). Under this method the plants can be set out in the field without disturbing the roots, and the consequent absence of the transplanting shock usually advances the first pick by about two weeks. A similar result may be obtained if seeds are planted directly in the field in "hills" which are ultimately thinned to one or two plants.



Plate 2.

Tomato Seedlings in Galvanized Iron Cylinders Which are Open on One Side.
Plants raised in this way suffer little or no transplanting shock.

Watering.

Excessive watering of seedbeds should be avoided. There is, however, no hard and fast rule regarding the amount of water required, for some soils, such as red volcanic loams, dry out much more quickly than heavy black loams. In warm weather, daily watering is necessary, but in cool weather one or two waterings each week should suffice. Water should be applied in the morning.

LAND PREPARATION.

Tomato, egg plant, peppers and cape gooseberry crops occupy the ground for periods up to six months and the land must therefore be prepared for the crop with great care. The seedlings do not transplant well into soil containing a great deal of raw vegetable matter, and for this reason, a green manure crop should be turned in several weeks before planting so that the soil will be in good physical condition to take the seedlings. Normally, the land is ploughed to a depth of 8–10 in. and allowed to weather until a few weeks before planting. It is then ploughed again and finally brought to a good tilth with disc cultivators or harrows. Before transplanting, the plant rows are opened up and a basal fertilizer is applied in the drills. A scuffler or hoe is used to mix the fertilizer with the soil in the plant row.

TRANSPLANTING.

In 4-8 weeks after sowing, according to the time of the year and the locality, the seedlings should be large enough for transplanting. About a day or two before transplanting, they are hardened off by withholding water, but immediately before transplanting the seedbeds are given a good soaking to facilitate the removal of the seedlings

without excessive injury to the roots. For preference, transplanting should be done during cloudy or showery weather, but if the work is carried out in unfavourable weather, the young plants should be irrigated or alternatively watered in by hand. As a further precaution, particularly if the plants are large, the leaves should be trimmed to lessen transpiration until growth is resumed (Plate 3). During transplanting, the roots of the young plants should be kept damp by standing them in a bucket containing a puddle of soil and water, or alternatively by placing them in a shallow tray which can be covered with a wet bag.

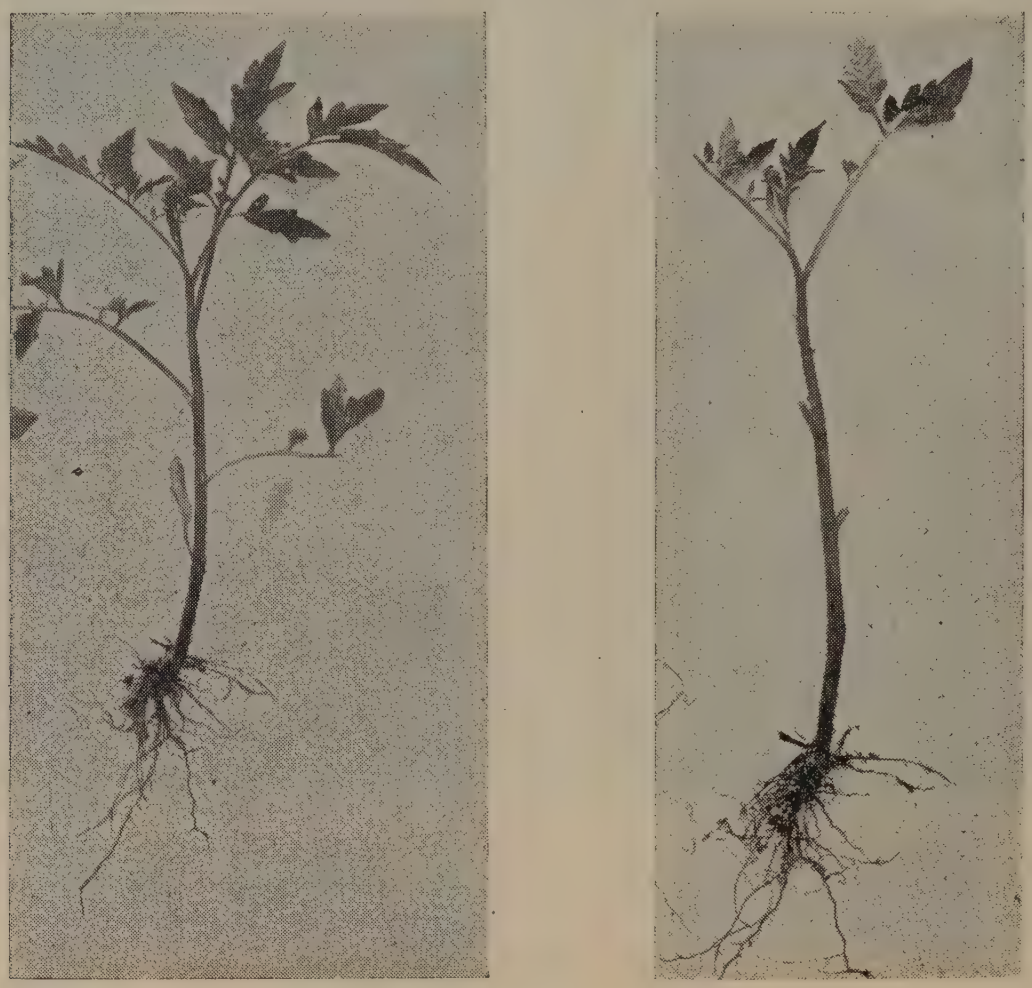


Plate 3.

Tomato Plants at the Transplanting Stage. The plant on the right has been trimmed to reduce moisture losses through the leaves.

When planting, a hole is first made in the ground with a short-handled hoe or by hand; it should be deep enough to allow the roots of the seedling to reach the bottom. A little earth is turned into the hole and the plant is then drawn slightly upwards before pressing the soil firmly around it. This ensures that the main root is not doubled up.

THE TOMATO.

The tomato (*Lycopersicon esculentum*) is grown as an herbaceous annual, and its fruit is botanically described as a berry. The plant is native to tropical America and was known in Europe prior to 1600. Since 1750, great strides have been made in the development of the crop. In Queensland, about 75% of the tomato crop is produced in three districts—the Granite Belt, the Brisbane area, and Bowen—the balance being contributed by the rest of the State. The fruit is in season practically the year round.

In the cool temperate climate of the Granite Belt (Plate 4), the crop is planted from October to early January and harvested in summer and early autumn. Little or no irrigation is practised in this area, but the rainfall is usually sufficient to ensure good crops of high-quality fruit. The more important varieties grown in this district are selected strains of Sioux, Grosse Lisse, Valiant and Rutgers.

In the Brisbane area, the crop is grown mainly under irrigation, with successive plantings throughout the year except the hot summer months of December and January. Autumn ground crops are field planted in late January and February. Cluster varieties grown on trellises and stakes are field planted during April for a winter harvest. An early spring crop is field planted during June, usually on trellises, though in some instances as a ground crop. Field plantings for the late spring ground crop are made in early August. The varieties favoured in this area for the autumn and spring crops are Grosse Lisse, Rutgers and Break o' Day. Salads Special, Potentate and Geraldton Smooth Skin cluster types are used for the winter crop.



Plate 4.

Contour-planted Tomatoes in the Stanthorpe District.

The tomato season in the Bowen district extends from March until the end of October. Field planting begins towards the end of the wet season and continues until June, while harvesting proceeds from June to September. The crop is grown under irrigation and most of the fruit is marketed in the southern States. The main variety grown is the locally named Bowen Globe (Plate 5), but other varieties of some interest in the district are Valiant and Sioux.

Plant Characteristics.

An undisturbed plant produces a strong tap-root two feet or more in length, with several lateral roots. When a seedling is transplanted, the tap-root often dies and the root system in the field consists mainly of lateral roots relatively close to the surface of the soil. Adventitious roots will arise on any part of the stem which is covered with moist soil.



Plate 5.

A Tomato Crop at Bowen, North Queensland, Showing the Great Vigour of Bowen Globe Plants.

The many branches of the plant are decumbent or partly erect. The stems are round, soft, brittle, and hairy when young, becoming somewhat hard and woody when old. The compound leaves are alternate, 5-15 in. long, pinnate, with 7-9 short-stemmed leaflets.

The tomato shows two distinct types of growth habit. The more common is the indeterminate type, in which a blossom cluster is usually produced at every third node and the plant is able to produce new terminal shoot growth indefinitely. The other type of plant is determinate and blossoms very freely, with a flower cluster at every node; the stem eventually terminates in a blossom cluster and no further shoot elongation takes place. A determinate plant is much more bushy than an indeterminate one.

In the common commercial globe varieties, small, yellow flowers are borne on the stems in clusters of 4-8, and in each cluster they open at intervals over a period of several days, those more basally situated developing first and producing the largest fruits. In the cluster and ornamental varieties, the flowers are more numerous and the fruits smaller than in the above types. The flowers are usually self-fertilised. The fruit is a 2- to many-celled berry with fleshy walls dividing the cells or cavities, which contain numerous small, flat seeds covered with short, stiff hairs.

Soil Requirements.

The tomato may be grown on soils of widely different types. The sandy loams and loams are preferred to both lighter and heavier soils, for they are less affected by extremes of dry and wet weather. Although excellent tomatoes are sometimes grown on fairly heavy soils, a healthy, vigorous crop may collapse if the drainage is bad.

Medium loams with a more or less uniform texture to a depth of about two feet are most suitable for tomato production under irrigation. Such soils may be cultivated within a reasonable period after rain.

Location and Aspect.

Areas suitable for tomato growing are protected from heavy winds, have a well-drained soil and are free from frost. In southern Queensland, warm slopes with a north to north-easterly aspect should be reserved for winter plantings, as this crop, though not easily grown, is a very valuable one. Southerly and westerly slopes may be used for early autumn plantings, which are normally harvested before cold winds and frosts occur. Low ground which is too wet for an autumn planting is often useful for a late spring crop, as the weather at that time of the year is usually fairly dry.



Plate 6.

A Ground Crop of Tomatoes Protected by a Windbreak of Sugar-cane.

Considerable damage may be done to a tomato crop by heavy winds, which not only injure the plants but also have an adverse effect on fruit setting. The crop may be protected by windbreaks. On the coast, an excellent series of temporary windbreaks can be made by planting rows of cowcane or pigeon pea across the farm and on the headlands (Plate 6). Windbreak spacings of 40 yards work well in practice. If the windbreak is planted in spring, it has usually grown sufficiently high by early autumn to protect the new season's crop.

Varieties.

Innumerable varieties of tomato have been developed in many countries for specific purposes. These differ in their habit of growth, the appearance of the fruit, and their susceptibility to disease attacks. In Queensland the range of suitable commercial types has been reduced to a relatively small number, chief among which are:—

Sioux.—An early tomato which is ready to harvest 10 weeks after transplanting and yields heavily until the final picking. The bush is indeterminate, medium sized, open and sprawling, with long, narrow leaves. The fruit is large in size, slightly flattened in shape and pale green when mature; it ripens to bright red. Cracking is uncommon. The strain certified in Queensland is known as Q1.

Red Cloud.—A first early tomato which is ready to harvest 10 weeks after transplanting. The bush is indeterminate, medium sized, semi-erect to sprawling, and has moderately narrow leaves. The fruit is globe to flat globe in shape and pale green when mature; it ripens to a bright red. Yields are very variable.

Break o' Day.—An early variety, which is ready to harvest in 10-11 weeks after transplanting and has a long cropping period. Indeterminate in habit, it has an open sprawling habit of growth and medium-narrow leaves. The fruit is globe shaped and rather subject to radial and circular cracking when conditions are dry; losses from sunburn are sometimes heavy.

Grosse Lisse.—A mid-season variety which is ready to harvest in 11–12 weeks after transplanting. It has an extended cropping period. Indeterminate in habit, it produces a semi-erect to spreading bush with medium-dense foliage and normal leaves. The mature fruit is large, slightly pointed in longitudinal section, green in colour with dark-green shoulders, and ripens to a bright red. It has good carrying qualities. The strain certified in Queensland is known as Q2.

PLANTING TABLE FOR VARIETIES.

Time of Planting Out.	Varieties Recommended.
A.—For Coastal Southern Queensland.	
February to March (ground crops)	Q1 or Sioux, Q2 or Grosse Lisse, Q4 or Rutgers, Red Cloud, Break o' Day
April to May (off-the-ground crops)	Salads Special, Potentate, Geraldton Smooth Skin
June to August (ground crops)	Q1 or Sioux, Red Cloud, Break o' Day, Rutgers, Grosse Lisse
B.—For Coastal Tropical Queensland.	
February to June (ground crops)	Q1 or Sioux, Red Cloud, Stokesdale, Grosse Lisse, Valiant, Bowen Globe
July to September (ground crops)	Burwood Prize, Red Cloud
C.—For Cool Tablelands.	
October to January (ground crops)	*First Choice :* Q1 or Sioux, Q2 or Grosse Lisse, Q3 or Valiant, Q4 or Rutgers *Second Choice :* Among others, good varieties are Break o' Day and Pearson.

Rutgers.—A late variety. The plant is indeterminate, with an erect and dense bush with large leaves. The fruit is medium in size, globe to deep globe in shape; when mature, it is green in colour with dark-green shoulders, and ripens to orange-red. The strain certified in Queensland is known as Q4.

Valiant.—Mid-season to late, determinate in habit, with a compact, erect bush. Fruit deep globe; when mature, it is green in colour, with dark-green shoulders, and ripens to a bright red. The strain certified in Queensland is known as Q3. An indeterminate type is commonly grown in southern States.

Bowen Globe.—A mid- to late-season variety grown almost exclusively in the Bowen district under irrigation. The bush is very vigorous, open and sprawling, with globe shaped fruit which is pink in colour. The cropping period is exceptionally long.

Transplanting.

Where possible, field planting is done on a cool day, but if this is not practicable, seedlings may be transplanted in the afternoon. Some latitude is permissible, however, on farms with irrigation facilities.

All small, misshapen and blemished plants should be discarded and the remainder more or less graded for size; the grading for size can, however, be done to a large extent by selecting the more forward plants in the seedbed. The smaller plants left in the bed will very often improve in size rapidly, and can be planted a week or so later if necessary. The crowns of the plants should be kept as free from dirt as possible.

When setting the plants in the field, they are placed deeper than they were in the seedbed. This encourages deep rooting and helps to keep them upright.



Plate 7.

Planting Out with Mechanical Aid at Bundaberg. Note that the seedlings are in individual containers.

As soon as practicable after the plants are set out they should be watered, each plant receiving 1-1½ pints of water. This settles the soil around the roots and ensures that lack of moisture will not hinder the rapid establishment of the field crop. Care in transplanting is very well worth while, for replacements are rarely satisfactory. It is highly desirable that only good, well-grown plants be set out and that they be planted as quickly as possible after they are taken from the seedbed.

"Buck" Plants.

In plantings of some varieties of tomato, "buck" plants occur. When young, these plants are much sturdier than the others and have short internodes, small leaves and numerous laterals. They do not crop satisfactorily and bear small numbers of misshapen fruit. The "buck" plants can often be detected in the seedbeds when the seedlings are only 3-4 in. high. If they are noticed after transplanting, they should be removed immediately and replaced by good plants. One method of guarding against this trouble is to obtain seed from reliable sources only.

The varieties grown in Queensland which commonly show "buck" plants are Salads Special, Walker's Recruit, Planter's Favourite and Australian Dwarf Red.

Planting Systems and Pruning.

The systems adopted for growing tomatoes in Queensland are:—

(1) Ground crops grown without any mechanical support.

(2) Cradled crops supported by wires at the sides of the bush.

(3) Trellised crops trained along twine joining two wires in the plant row.

(4) Staked crops tied to a 1 in. x 1 in. stake in each plant position.

In a trellised or staked crop which is being trained to a single stem, all lateral growth from the leaf axils and the base of the plant is removed every 10 days or so during the growing season. If the tomatoes are being trained to two stems, the lateral immediately below the first flower cluster is allowed to develop and form the second arm of the plant, but all other laterals are removed.

Pruning should be done by breaking out the shoots; cutting or pinching them out is inadvisable as there is a danger of spreading some virus diseases by these methods. When the plants reach the top of the trellis or stake, the growing tips may be broken out if desired.

Ground Crops.

In Queensland, most tomatoes are grown as ground crops. Ground crops are much cheaper to plant and maintain than crops grown by the other methods, but losses from blemishes, diseases and pests are greater, particularly in the winter months. The fruit is relatively well protected from sunburn; this is most desirable during hot weather. Determinate varieties such as Pearson and Q3 are suitable only for use as ground crops, but indeterminate varieties can usually be adapted to any planting system.

Planting distances vary with the district and the variety grown. A spacing of 6 ft. between rows and 2½-3 ft. between plants in the row is frequently used for varieties such as Break o' Day. The Bowen Globe is planted much wider (10 ft. x 8 ft.) and upright types such as Pearson and Q3 may be planted closer (4½ ft. x 3 ft.) When close-planted in the rows, the plants grow together quickly and thus are not blown about so much as they would otherwise be. Square planting is commonly adopted in districts where two-way cultivation is practised. Except in the Bowen Globe variety, from 1,000 to 2,000 plants may be required for each acre of tomatoes planted as a ground crop; the number needed in the case of Bowen Globe is much less.

Cradling.

Cradling (Plate 8) was popular some years ago in the Brisbane area, but trellising is now more widely practised. Cradling is useful during the autumn months, especially for thick, bushy varieties which are not easily pruned, as it keeps the plants up off the ground, fruit wastage from ground rots is kept to a minimum, and the fruit is not difficult to pick. No pruning is required.



Plate 8.

Tomatoes Grown on the Cradling Method.

The cradle (Plate 9) is constructed by placing short hardwood posts 2 ft. 6 in. in the ground and 2 ft. 3 in. high (4ft. 9 in. overall) at each end of the cultivated field. These should be set at a slightly backward angle and well stayed. Five feet is the usual spacing between the rows. Hardwood intermediate posts 3 ft. 3 in. long are placed in line and driven into the ground every 12 ft. so that the actual height is 2 ft. 3 in. Each intermediate post has two holes bored through it—one almost at the top and the other about 15 in. below the first. These holes need be only of ordinary nailbit size (No. 5) to carry a short wire pin made from 10 or 12 gauge galvanised or steel wire. The wire pins carry the cross-arms. The top cross-arm should be 2 ft. x 1½ in. x 1½ in. sawn hardwood with a centre pin-hole and a ½ in. sawn slot in each end. Two top wires are run from each side and very near the top of the strainers. Similarly, two wires are

LOW TRELLIS TO AVOID PRUNING.

Fig 1. Top Cross Arm 24" x 1½" x ½" made of sawn hardwood with hole bored for wire pin and sawn slots in each end.

Fig. 2 Lower Cross Arm 12" long and otherwise similar to the top arm.

Fig. 3. Dropper 3' 3" long x 2" x 2" bored about 2" from top and 15" further down. Pointed at the bottom end and driven about 12" into the ground.

Fig 4 Wire pin about 6" long made from 10 or 12 gauge wire and used for pinning Cross Arms to Droppers.

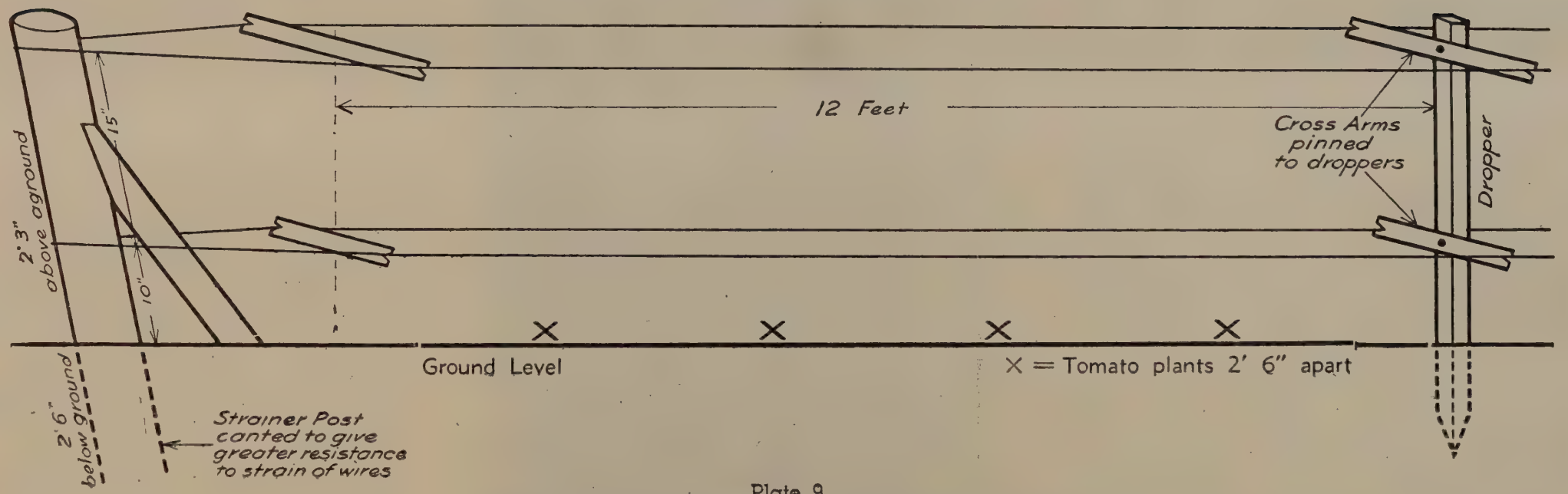


Plate 9.

Sketch Showing the Method of Constructing a Cradle.

run from each side of the strainers at about 10 in. from the ground. The wires are strained tight, the cross-arms placed in position, and attached to each dropper with a wire pin, which is then bent over.

The seedlings are planted between the wires at a 2½-3 ft. spacing (approximately 3,000 plants per acre). Depending on their position, the laterals are spread over the lower or the top wire, and allowed to grow towards the ground again.

Trellising.

Trellising of winter and spring tomatoes (Plate 10) is general throughout the Brisbane area. Although a lot of work is involved in erecting the trellis and training the plants, the system has many advantages. The crop is easier to pick, spray and irrigate, while the fruit is large, of excellent quality and relatively free from defects.



Plate 10.

A Trellised Crop Under Furrow Irrigation at Rockhampton.

Salads Special and other cluster varieties which usually crop well under winter conditions are grown almost exclusively on trellises. Because of their small fruit they must, however, be pruned if the crop is to meet market requirements at that period of the year.

Two types of trellis are in common use. The first (Plate 11) is constructed by sinking two strong posts of about 7 in. diameter and 7 ft. long firmly in the ground to a depth of 2 ft. 6 in. at the ends of each row with the usual stays. The rows are spaced 4 ft. 6 in. apart. Between the posts, strong hardwood stakes are driven into the ground every 12 ft. to act as intermediate supports; the end posts are bored at about 9 in. and 4 ft. 6 in. above the ground level to carry two 12½ gauge wires, which are tightly strained and stapled.

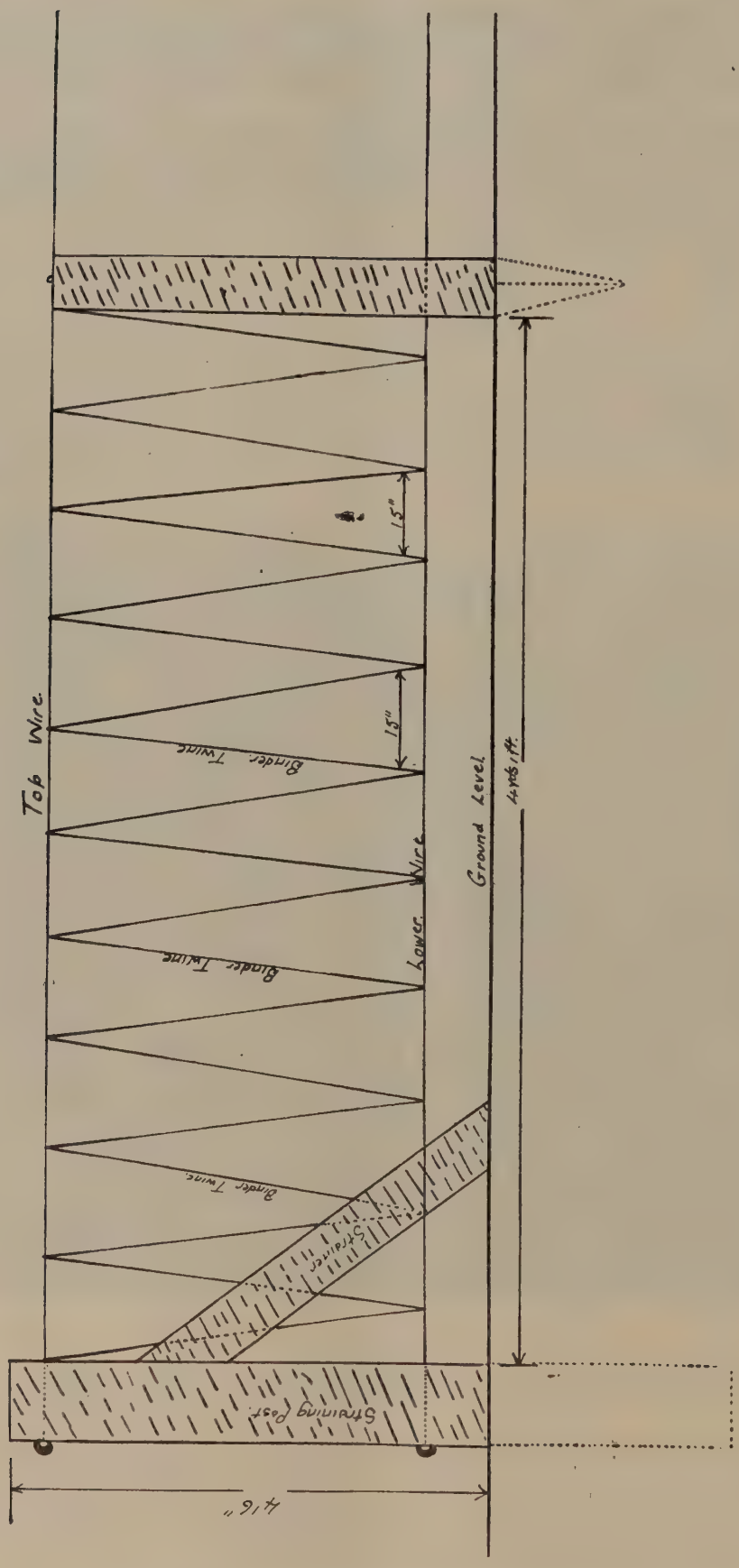


Plate 11.
Sketch Showing Method of Constructing a Trellis.

In the second type of trellis, the holes for the posts at the ends of the rows are dug with an 8-in. soil auger to a depth of 3 ft. at an angle of about 60 degrees and a post of about 7 in. diameter and 8 ft. long is dropped into each hole. There is no need to stay these posts. The posts are bored at the 9 in. and 4 ft. 6 in. levels and 12½ gauge wire is strained through them. The intermediate supports are small posts about 4 in. in diameter and 6 ft. 6 in. long, set firmly into the ground every 22 yards to a depth of 2 ft. Between the intermediate

posts are four hardwood droppers which rest on the ground. The top wire is stapled to the tops of droppers and intermediate posts, while the bottom wire is stapled to the sides. If the staples are not driven in too far they can be removed at the end of the season and used again.

Both trellises are completed by tying the end of a ball of binder twine to the top wire and passing the ball down under the bottom and back over the top wire to form a "V" pattern. The bottoms of the "V"s should be 15 in. apart, which is the space between the plants in the rows. A 7 lb. ball of twine will cover approximately 7 chains of trellis.

The young plants are set out immediately under each "V" and an arm is trained up each length of twine. When the trellised rows are 4 ft. 6 in. apart, approximately 7,000 plants are required to the acre.

Staking.

Staking (Plate 12) has been largely replaced by trellising in most districts. Hardwood stakes about 1 in. square and 7 ft. long are driven 2 ft. into the ground at 18 in. spacings in rows 4 ft. 6 in. apart. The stakes can be driven with a piece of 2-in. pipe about 2 ft. 6 in. long with a plug in one end. The stake is placed in position, and the pipe slipped over the top and operated in pile-driver fashion. A plant is placed at each stake and each is pruned to one or two stems.



Plate 12.

A Staked and Pruned Crop at the Four-hand Stage.

The stem is tied to the stake every 12-15 in. with binder twine. The tie is made loosely so that it does not cut the stem and should be placed under a leaf where possible. The twine is passed around the stem, crossed, and again wrapped around the stake twice before knotting.

Cultivation.

If the ground has been well ploughed and thoroughly prepared for the tomato crop, there is no need for deep cultivation at any stage during the growing period. On most types of soil, shallow cultivation when the weeds are small will do all that is required. Deep cultivation injures the root system of the plant and there is always the risk of cultivating too close to trellised plants in order to avoid chipping. Ground crops are probably not seriously affected, as the bush itself prevents implements from coming in too close after the crop is a few weeks old.

When the crop is topdressed, the fertilizer is distributed along the sides of the row. The first rain or irrigation will dissolve the material and carry it down to the roots of the plant, but if necessary, the fertilizer can be worked into the soil by a light cultivation. The opening of a deep furrow for the fertilizer alongside the plants, particularly when the crop is starting to set fruit, may offset any benefits which might be derived from the addition of the fertilizer.

If necessary, the plants may be hilled up slightly a few weeks after planting out.

Fertilizing.

The production of good-quality tomatoes is closely linked with correct fertilizing methods. Vigorous, healthy bushes tend to produce good yields of first-class tomatoes, while poor yields and inferior fruit are associated with unthrifty plants. Since the necessary plant foods can be largely provided by proper methods of fertilizing, the grower is able to exercise a considerable measure of control over both yield and quality. Few soils in Queensland grow a good tomato crop without fertilizer. Crops on some virgin scrub soils of high natural fertility may yield reasonably well without fertilizer, but even in such cases the addition of suitable fertilizers will usually result in greater production.

In designing a fertilizer programme for tomatoes, the grower has to consider the type of fertilizer to be used, the amounts required, placement and time of application.

Type of Fertilizer.

The most satisfactory fertilizer for both the pre-planting and early side-dressing applications is a complete mixture containing nitrogen, phosphoric acid and potash. The pre-planting mixture should have approximately 4·5% nitrogen, 13·5% phosphoric acid and 5% potash. This mixture also gives good results when applied as a side-dressing. A suitable mixture may be composed solely of the water-soluble fertilizers or it may contain both soluble and insoluble constituents.

For the pre-planting application, a mixture which is partly soluble and partly insoluble is preferred because there is less likelihood of loss from leaching by rain or irrigation water before it is taken up by the plant. In such a mixture, some of the nitrogen and phosphoric acid is contained in blood and bone. In contrast to the pre-planting mixture, the side-dressing should be wholly water-soluble—that is, it should contain only ammonium sulphate, superphosphate and muriate or sulphate of potash.

Amounts Required.

When using a pre-planting mixture with a formula such as 4·5/13·5/5, a normal rate of application is 7 lb. per chain row, or about 8 cwt. per acre with rows 5 ft. apart, for the heavier soils such as loams and clay loams. On sandy loams, this amount can be reduced to 5 lb. per chain, or about 6 cwt. per acre, provided the amount applied as a side-dressing is increased proportionately.

In general, only one side-dressing is required on the heavier soils when the correct pre-planting dressing has been applied. This side-dressing should be approximately 3 lb. of the water-soluble mixture per chain row. On the lighter soil types, the side-dressing is increased to 4 lb. per chain row. In the case of trellised or staked crops on light soils, the side-dressing can with advantage be divided into two applications with an interval of about 3 weeks between them. Since ground crops spread over the surface of the soil, it is difficult to apply a late side-dressing effectively. However, if the variety has a compact and erect habit, the method recommended for trellised or staked crops is applicable.

A water-soluble fertilizer which supplies nitrogen only, such as ammonium sulphate, may be used as a late side-dressing for trellised or staked crops. It is applied when harvesting of the lower hands begins. The application of nitrogen at this period stimulates the growth of the plant and assists in the production of fruit of marketable size and quality from the uppermost clusters. A suggested rate is 2 lb. of ammonium sulphate per chain row.

Placement and Time of Application.

The pre-planting fertilizer should be placed in a band along the length of the row rather than broadcast over the whole surface. The most efficient method of doing this is to open up a drill about 8-10 in. deep, throw the fertilizer as evenly as possible along the bottom and lower portions of the sides and then work it into the soil immediately. Most of the fertilizer will then be directly below the plant and yet be sufficiently deep to ensure that the seedling is not placed directly into soil containing a high concentration of fertilizer.

When the pre-planting mixture contains part of its nitrogen and phosphate as blood and bone, it should be applied in the drill a week or more before planting out and well mixed with the soil. When using such a mixture, there is little risk of losing plant foods from the soil except under very wet conditions.

The side-dressing should be applied along both sides of the row in a band 4 in. from the base of the plant row and 18 in. wide. This application is not applied until the first fruit cluster has set, which is usually 3-5 weeks after transplanting Only shallow cultivation is needed to work the fertilizer into the soil. Whenever a side-dressing is applied, every care should be taken to avoid injuring the roots in the following cultivation.

In fertilizing the tomato crop, it should be borne in mind that excessive vigour is sometimes associated with faulty flower setting and consequent poor yields. Excessive use of nitrogen may increase this tendency.

Liming.

The tomato plant is rather tolerant of acid soil conditions and is often grown satisfactorily in soils which are too strongly acid for many other crops. However, optimum growth occurs when the pH is between 5·5 and 6, and it is therefore sometimes desirable to add either lime or dolomite to the soil. Continuous cultivation, especially under irrigation, and the use of acid fertilizers such as sulphate of ammonia tend to increase soil acidity, and periodical liming is necessary to restore the pH to a satisfactory level. When tomatoes are grown in rotation with such crops as cabbages, cauliflowers, beans, beetroot and lettuce, and lime is applied to these crops, further applications of lime or dolomite are not then required for the tomato crop. Tomatoes grow best in a soil which is well supplied with organic matter. Green manure crops, which are included in the rotation to add organic matter to the soil, usually grow best in a soil which is not highly acid. Occasional applications of lime to these crops will, therefore, benefit the tomato crop. The need for such applications can be determined periodically by simple laboratory tests.

When soil acidity has to be corrected, lime or dolomite should be applied to the cropping area before the land receives its final preparation for planting. These soil amendments can usually be applied within a few weeks of planting They should be broadcast and incorporated into the soil by the usual cultivation methods at the rates shown below (an application of 224 lb. to 1 sq. chain is equivalent to 1 ton per acre). The figures are for dolomite, processed lime or ground limestone.

Degree of Acidity.	Sandy Loams.	Loams.	Clay Loams.
	Tons per acre.	Tons per acre.	Tons per acre.
Acid (pH 5·0-5·5)	1	1½	2
Strongly acid (pH 4·5-5)	1½	2	3

Green Manures.

An effective way of replenishing soil organic matter is to grow cover crops (Plates 13-15), which have an important place in any well-regulated system of farm and soil management. In areas where the land is not normally in production during the wet summer months, the cover crop is particularly important, for it protects the soil from heavy rains which not only cause erosion but also compact the ground and make it difficult to work. Unless the cover crop follows a cash crop which has received liberal applications of fertilizer, it usually pays to fertilize the area before sowing. Suitable dressings are:—legumes, 2 cwt. of a 4·5/15/2·5 mixture per acre; non-legumes, 1½ cwt. of sulphate of ammonia per acre.

A number of plants can be used as cover crops and the grower should select those which are known to grow satisfactorily in his particular district. Those in common use are:—

Legumes.—

Summer-growing.—Cowpea (varieties Reeves, Poona, Groit and Cristaudo), pigeon pea, and velvet bean.

Winter-growing.—New Zealand blue lupin, field pea, and golden tares.



Plate 13.

A Maize Crop Being Disced Prior to Turning Under for Green Manuring Purposes.



Plate 14.

Discing Poona Pea to be Turned Under as a Green Manure Crop.



Plate 15.

A Good Green Manure Crop of Pigeon Pea.

Cereals.—

Summer-growing.—Maize, Japanese millet, white panicum, sorghum, and Sudan grass.

Winter-growing.—Oats, rye, and wheat.

Irrigation.

Most tomato crops in the Granite Belt are grown during the summer without irrigation. In other parts of the State, however, production is seldom attempted in the wet summer months and irrigation facilities are more or less indispensible during winter and spring for most commercial growers who specialise in the tomato crop. Two methods of irrigation are practised—furrow and spray.

Furrow irrigation is the system normally used at Bowen and to a lesser extent elsewhere where ample supplies of underground or surface water are available at a reasonable cost. The system is well adapted to the heavier soil types with an easy slope to give the required run. Installation costs are low, for there is no expenditure on spray lines other than the head mains. The normal practice on ground crops is to open up a furrow on each side of the row after the crop is planted. These furrows are used to distribute water in the first and sometimes the second irrigations. The amount of water applied is controlled by the use of check mounds in the furrow. Later, the crop is watered from one side only, each new furrow for irrigation being worked further away from the plant row so that injury to the root system is kept at a minimum. When opening up a furrow, the soil should be thrown towards the plant row and not away from it. The third or fourth

furrow made is allowed to remain permanently for the remainder of the crop cycle. By that time, cultivation is more or less impracticable and the sole aim is to get sufficient water to the plants to fill out the later-set fruit.

The main merits of spray irrigation are its suitability for light soils and the more uniform coverage obtained. The Skinner system (Plate 16) is widely used in the Brisbane district, water being fed through 2-3 in. mains to 1-1¼ in. spray lines with nipple outlets spaced approximately 2 ft. 6 in. apart along the line. The angle of discharge is controlled by a lever at the end of each line. The popularity of the system, in spite of the high cost of installation, is due to its suitability for areas in which water supplies are limited; a pressure of 30 lb. per sq. in. in a 2½ chain spray line delivers about 500 gallons per hour over a bay 33 ft. wide. Disadvantages of the system are the heavy work of moving lines (unless the producing area is completely equipped



Plate 16.

Irrigating Tomatoes by the Fixed Overhead Perforated Pipe System.

with permanent lines) and the necessity for adjusting the feed angle at short intervals to ensure even soil coverage. When greater quantities of water are available, rosette and rotating outlets can be used on 3-4 in. portable spray lines. These lines do good work but frequently do not stand up well to hard usage.

Sufficient water must be applied to ensure even and rapid growth, but excessive water can be harmful, particularly on ground-grown tomato crops which are bearing; rots develop very quickly in maturing fruit which is on or close to the ground. The tomato plant draws much

of its moisture from 6-9 in. below the surface of the soil. A dry mulch on the top of the ground is, therefore, not necessarily an indication that the plants require water. Before irrigating, the soil moisture in the 6-12 in. layer should be checked.

Some irrigation principles worth noting are:—

(1) Irrigation is only necessary when the soil shows signs of drying out in the root zone of the crop.

(2) Less water is required on light than on heavy soils at each application. In the lighter soils, one inch may be sufficient to link the applied water to the wet soil layer underneath, while twice that amount can be necessary in a heavy loam. Moreover, frequent waterings are usually necessary on the lighter soils.

(3) The rate of application should be adjusted to the intake capacity of the soil. Too heavy rates of application lead to puddling and soil loss through erosion.

(4) The tomato is a relatively deep-rooted plant, and heavy infrequent waterings are therefore preferable to light frequent ones.

Harvesting.

Harvesting from any one crop normally extends over a period of 6-8 weeks, but is much longer in the case of the Bowen Globe. Pickings are made either once or twice in each week, depending on the size of the crop, the time of the year, transport facilities and the requirements of the markets being supplied. Normally only mature green fruit is forwarded to the more distant markets. However, coloured fruit of the cluster varieties grown in the Brisbane district is placed on the Sydney market from August to early October. Mature green fruit varies in both appearance and firmness in the several commercial varieties, and experience in picking is essential if the fruit is to be marketed in good



Plate 17.

Harvesting a Trellised Crop of Tomatoes Near Brisbane.

order. Mature green fruit must be fully grown, pale green in colour, glossy in the skin and the flesh around the seed deep amber in colour. Immature fruit will not develop full colour or flavour.

At each pick, mature green and coloured fruit is harvested into tins, working from the bottom hand along the stems of the plant. Sound fruit must be handled carefully, and if necessary the tins of fruit should be covered with bags to protect them from the sun until they reach the packing shed. In the packing shed, the fruit is graded for size and evenness of colour. The better packs should be free from cat-face, ring cracks and other blemishes. Packing methods are now more or less standardised, the half-bushel case being generally used in Queensland.

Yields range up to 2,250 half-bushel cases per acre.

Saving Seed.

The tomato plant is very susceptible to its environment and many growers therefore save their own seed from selected plants in each crop grown. The practice is sound if precautions are taken to ensure that the plants from which the fruit is reserved for seed extraction are true to type and free from disease.

The normal procedure is to mark (with stakes) the more attractive plants in the crop and examine them regularly during the season. These should be well-grown, free from disease and show the plant and fruit characters considered desirable. Any which show symptoms of virus diseases or which bear a good first hand and inferior later hands must be rejected. At the height of the cropping period the selected plants can be reduced to the best six. The fruit from the lower three hands in each plant should be reserved for seed.

Fruit for seed extraction may be harvested in the mature green stage and then ripened on the bench, or is allowed to ripen on the plant. In extracting the seed, the fruit is cut in halves and the pulp squeezed into a wooden barrel or some other vessel constructed from a non-corroding material. The vessel is covered and the pulp is allowed to ferment for 2-5 days according to prevailing temperatures. During fermentation most of the good seed will sink to the bottom of the vessel. When fermentation is complete, the floating pulp may be separated from the sunken seed by pouring off, and then by repeated washing, stirring and pouring off the remaining sound seed may be separated from the pulp. When the seed has been washed clear, it should be thinly spread out on clean hessian and thoroughly dried under atmospheric conditions as quickly as possible. When dry the seed should be rubbed briskly to break up the clusters and packed in airtight containers. A half-bushel case of fruit will yield approximately 1 oz. of seed.

An alternative rapid and effective method of extracting seed is to mix concentrated hydrochloric acid with tomato pulp, at the rate of 1 fluid oz. to 5-6 lb. of pulp. The lot is mixed thoroughly and repeatedly with a suitable stirring rod during a period of three hours. At the end of that time, the seed is separated from the pulp and is carefully washed in at least four changes of fresh water. This extraction must be done in glass or porcelain vessels and all necessary precautions taken with the acid, which is highly corrosive.

Well-dried seed will, if stored in airtight containers, retain its viability for at least three years.

THE CAPE GOOSEBERRY.

The cape gooseberry (*Physalis peruviana* L.) is a native of Peru and in no way related to the English gooseberry.

Two varieties of cape gooseberry are grown in Queensland, the more common being a small-fruited type with yellow berries which measure half an inch or a little more in diameter. The other, known as Golden Nugget, bears slightly larger fruit. Both can be used in jams and preserves, but the small-fruited variety has the better flavour and is much preferred for factory fruit.



Plate 18.

A Vigorous Cape Gooseberry Crop at Sunnybank, Near Brisbane.

The plant is an herbaceous perennial, commonly growing to a height of 3 ft. and having a spread of 5-6 ft. (Plate 18). The fruit is enclosed in an inflated calyx—the "husk" (Plate 19). Though the plant is a perennial, it is invariably cultivated in Queensland as an annual. In the southern part of the State, the main crop is harvested between May and September.

Climatic and Soil Requirements.

The growing conditions required by the cape gooseberry and the cultural methods used for the field crop are similar to those suitable for the tomato. In southern Queensland, the plant is favoured by a warm spring and summer climate with abundant rain, but relatively dry weather is desirable when the crop matures and harvesting is in progress. Severe frosts may kill most of the aboveground portion of the plant.

The most suitable soils are sandy loams and loams, but provided drainage is reasonably good, the plant makes good growth on a wide range of soil types.



Plate 19.

Cape Gooseberry Fruits. Top, fruit in inflated calyces ("husks"). Bottom, husked fruit and flowers.

Propagation.

The cape gooseberry is propagated from seed and the methods used in raising tomato seedlings are equally suitable for this plant. However, germination is frequently slow and irregular. There are 5,000-8,000 seeds to the ounce, and this quantity is usually required to provide sufficient plants for an acre of ground.

Plants are raised during spring and early summer in well-prepared seedbeds, and the seedlings are later thinned or pricked out into nursery beds in which the rows are about 6 in. apart and the plants 2-4 in. apart. The seedlings should be ready for transplanting in the field about eight weeks after sowing.

Planting Out.

Planting out in the field should, of course, be preceded by thorough soil preparation. Planting distances vary according to the fertility of the soil. In sandy soils plants may be set out at intervals in rows 6 ft. apart, but in richer loams the plants may be set 4-6 ft. apart in the row, with a distance of 7-8 ft. between rows. Under this system of planting

900-1,800 plants are required per acre. If horse- or tractor-drawn implements are to be used in the early stages of plant growth, a wide spacing is desirable. The plants are set out in late summer or early autumn. Spring planting is hazardous in some localities because the crop is very liable to attack by corn ear worm and red spider. The cape gooseberry has a large proportion of its feeding roots near the surface of the ground, and as these roots spread across the rows, cultivation with implements must be shallow and kept to a minimum. Light cultivation with hand tools should suffice for weed control during the later stages of growth.

Fertilizing.

A basal fertilizer application can be made by opening a furrow along the row to be planted and then spreading 4 oz. of a complete fertilizer at each plant position. After turning another furrow, the seedlings can be set out. A basal dressing can also be applied by opening a hole with a hoe, spreading and mixing the fertilizer in it and then planting. Some growers omit the basal dressing and topdress the plants when they are established, the mixture being chipped into the soil with a hoe. Suitable mixtures contain 5-8% nitrogen, 10-15% phosphoric acid and 5-6% potash.

Topdressing with sulphate of ammonia or the above mixtures, when the plants are about half-grown, is practised at times with beneficial results.

Harvesting and Marketing.

The crop will begin to mature approximately three months after planting out and harvesting may extend over a period of a further 2-3 months. Maturity of the berries is indicated by a change in the husk colour from green to pale brown and at this stage the fruit commences to fall from the bush; the fruit then is yellow. There is some advantage in gathering the fruit from the ground rather than picking it from the plant, as the fallen fruit is reasonably uniform in both colour and maturity. The fruit should be gathered at regular intervals and it is well to jar or shake each plant so that all mature fruit will fall to the ground. Harvesting should not commence until morning dew has dried from the fruit.

If necessary, the berries should be spread out in thin layers for a day or two to dry. Preparation for market includes the dehusking of the fruit and placing it in suitable containers. Two-pound boxes are preferable if the fruit is to be forwarded to the fresh fruit market and 12 lb. boxes or half-bushel cases (holding about 26 lb.) if it is to be sent to the factory.

Yields and Bearing Period.

Under good cultural and growing conditions, the cape gooseberry can be expected to yield 3,000 lb. of fruit per acre, but heavier yields are obtained from time to time.

EGG PLANT.

The egg plant (*Solanum melongena*) is probably a native of India and has been in cultivation a long time in Asia and southern Europe.

The plant is an annual, with a compact bush which attains a height of 1½-4 ft. The stems are woody. The leaves are large, simple, and oval or ovate. The stems and leaves are often armed with spines, but these are much reduced in the so-called spineless varieties.

The flowers are large and purple in colour; they are formed progressively throughout the growing season. Self-pollination is common, though considerable crossing occurs.

Varieties.

Black Beauty.—A large-fruited, dark purple variety. The fruits are slightly elongated and taper towards the stem end.

New York Spineless.—A large-fruited variety, somewhat lighter in colour and more elongated than Black Beauty.

Culture.

The plants raised in seedbeds are sometimes transplanted into pots or some other type of individual container in order to reduce planting shock. In southern Queensland, sowings should be made during August and September for field planting during October and November, but in coastal North Queensland field planting takes place from April to June. One ounce of seed should be sown for each acre of field to be planted.

Seedlings are large enough for transplanting about 6-8 weeks after sowing. The smaller varieties are spaced 18 in. to 2 ft. apart in rows 3-4 ft. apart, but larger varieties are spaced about 3 ft. apart in the rows. The egg plant resembles the tomato in its cultural requirements, but it has a longer growing season and is more seriously checked in growth by cool weather. The fruit begins to mature about three months after transplanting.

A sandy loam which is well drained and plentifully supplied with humus should be selected for the crop. The cultivation and fertilizing programme is similar to that required for the tomato.

Harvesting.

The fruit of the most commonly grown variety in Queensland is harvested when it has reached the deep purple stage; it is then fully grown and the sepals at the stalk end tend to dry off and curl up.

Some varieties must be picked in an immature condition, before the flesh of the fruit becomes coarse and tough. Each fruit should be cut rather than pulled from the plant.

PEPPERS OR CAPSICUMS.

The sweet peppers or capsicums (*Capsicum frutescens*) and the pungent chili are distinct from the pepper of commerce, which is the fruit of *Piper nigrum.*

The capsicum plants are erect, compact in form, 12-24 in. high, regularly branched, and with angular herbaceous stems which become woody with age. Although peppers may be perennials in the tropics, they are usually cultivated as an annual crop. The flowers occur singly in the axils of the branches and are formed continuously throughout the season. They are either white or purple in colour. Self-pollination is general, but there also appears to be a considerable amount of cross-pollination. The fruit is a podlike hollow berry, borne on a short, stout peduncle, erect at first but in some varieties curving downwards at maturity.

Although of minor importance commercially, the various forms of peppers are widely cultivated in the home garden. The large-fruited, non-pungent, sweet peppers used in salads are grown as a market



Plate 20.

Capsicum Plants with Maturing Fruit.

garden crop (Plate 20). Cayenne, the red pepper of commerce, consists of the fruit of small pungent varieties and capsicum ground to a fine powder. In pepper sauces the pungent varieties are preserved in brine or strong vinegar.

Varieties.

Bull Nose (sweet)—Extremely large and blocky.

Chinese Giant (sweet)—Extremely large and blocky.

Ruby King (sweet)—Large and rather elongated.

Ruby Giant (sweet)—Large and rather elongated.

Long Cayenne (pungent)—Small, long, slender, and smooth-fruited.

Tabasco (pungent) (chili group)—Small, long, slender and smooth-fruited.

Culture.

Peppers and the tomato have a similar range of climatic and soil requirements. The plants are raised in seedbeds or boxes, although sometimes the seed of chili peppers is sown direct in the field. Field plantings coincide with those of the tomato. Planting distances are influenced by variety and irrigation facilities, but rows 2½-3 ft. apart, with the plants 18 in. apart in the row, are common. To ensure satisfactory cropping, equable growing conditions are necessary. A season of 3-4 months is required to mature the crop.

Harvesting.

The stage of maturity at which peppers are picked depends upon the purpose for which they are required. The large sweet peppers are usually picked mature green, although there is some demand for red ones. The fruits will remain on the plants for some time after maturity without deterioration. They are usually picked by snapping off the brittle stems with the hand. They are packed for market in various kinds of containers, including half-bushel and bushel cases.



The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

THE production of honey is dependent upon an abundant supply of nectar- and pollen-producing plants within easy flight range of the apiaries. The largest crops are obtained by beekeepers who have acquired a knowledge of the floral resources of their districts, and consequently maintain apiaries in the most suitable locations.

This article is the first of a series giving an account of plants important to beekeepers in the pastoral districts of Moreton, Darling Downs, Wide Bay and Burnett, which contain the principal honey-producing areas of Queensland (Plate 1). The information is based upon material supplied by commercial beekeepers and honey packers, and observations made by the writers over many years.

Because of variations in climatic and other factors, minor local differences in times of flowering and secretion of nectar may be found within the extensive tract of country comprising south-eastern Queensland.

To the beekeeper, the flower is the most important part of the plant. Although there are many different kinds, most flowers have a number of features in common. The *ovary* is the central part which later produces the seed. It sometimes has a stalk-like prolongation at the top called the *style*. Surrounding either the top or the bottom of the ovary are the *stamens*. Each of these consists of a thread-like stalk, sometimes very short, at other times quite long, carrying at the top an *anther*, or pollen-sac, which consists usually of two tiny compartments containing the pollen. The anthers open in different ways to shed the pollen grains. Outside the stamens are the *petals* and outside these again are the *sepals*.

In many flowers the petals are the showy part, but sometimes it is the stamens or the sepals that are most conspicuous, and some have no petals at all. In some flowers the sepals and petals are joined in their lower parts to form tubes, one inside the other; in these flowers the stamens are attached to the tube formed by the petals. Nectar is produced by small *glands* or *nectaries* usually placed between the ovary and the stamens.

After fertilisation, the ovary develops into the *fruit*, which contains the seeds. The fruit is often fleshy, but in most of the plants to be dealt with it is not so, and is then often called a seed-pod or *seed-capsule*. These seed-capsules are usually divided into compartments or *cells*, each of which may split separately or open by a lid-like *valve* to set free the seed.



Plate 1.

Sketch Map of the Region Containing the Principal Honey-Producing Areas.

The plants of greatest importance to the beekeeper may be grouped as follows:—

(1) **The Eucalypts.**—These are trees classified as species of *Eucalyptus* and include boxes, ironbarks, stringybarks, bloodwoods and gums. The flowers of eucalypts have no sepals or petals and appear to consist mostly of a large number of stamens. The bud opens by throwing off the upper part, known as the *lid, cap* or *operculum.* The opening of the bud by means of a lid is a very characteristic feature. The seed-capsules are divided into three, four, five or six cells, which open by valves. Usually there are four or five cells and the valves are not easily seen.



Plate 2.

Bark of Poplar Box (Eucalyptus populnea).

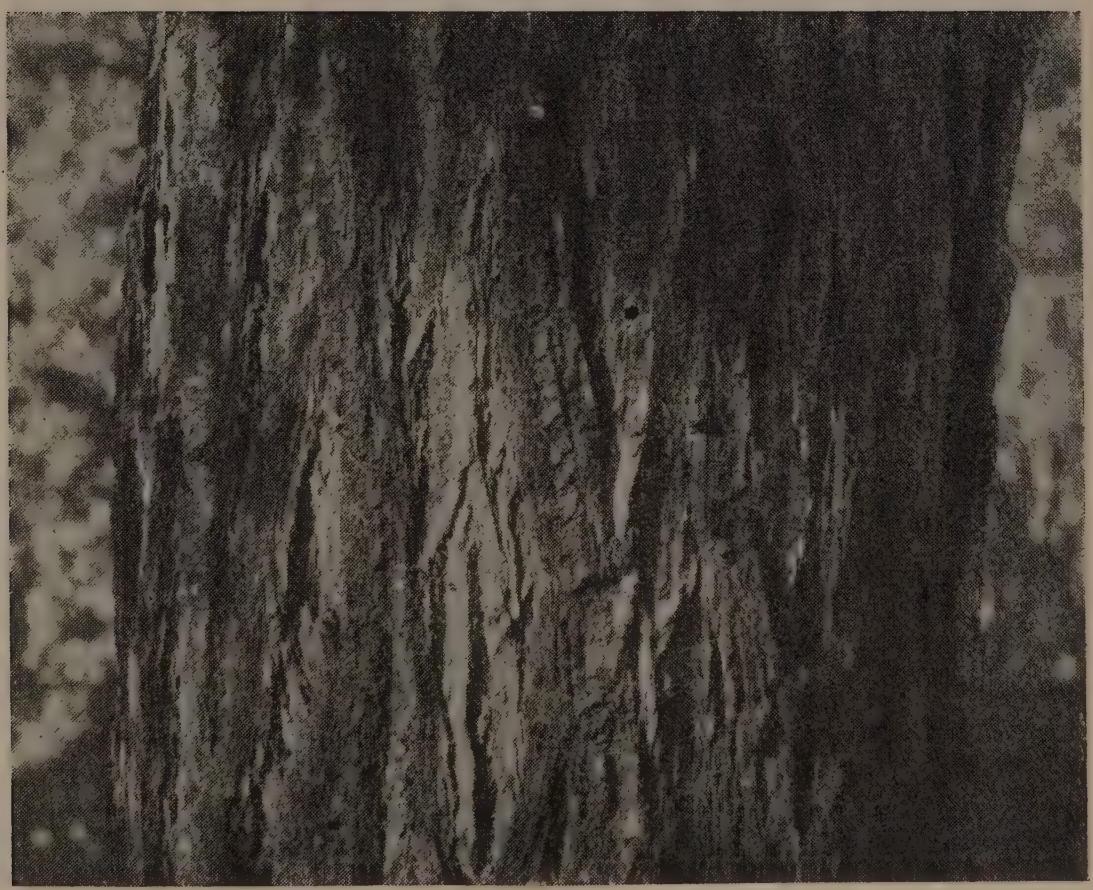


Plate 3.

Bark of Broad-leaved Ironbark (Eucalyptus siderophloia).



Plate 4.

Bark of a Stringybark (Eucalyptus umbra).

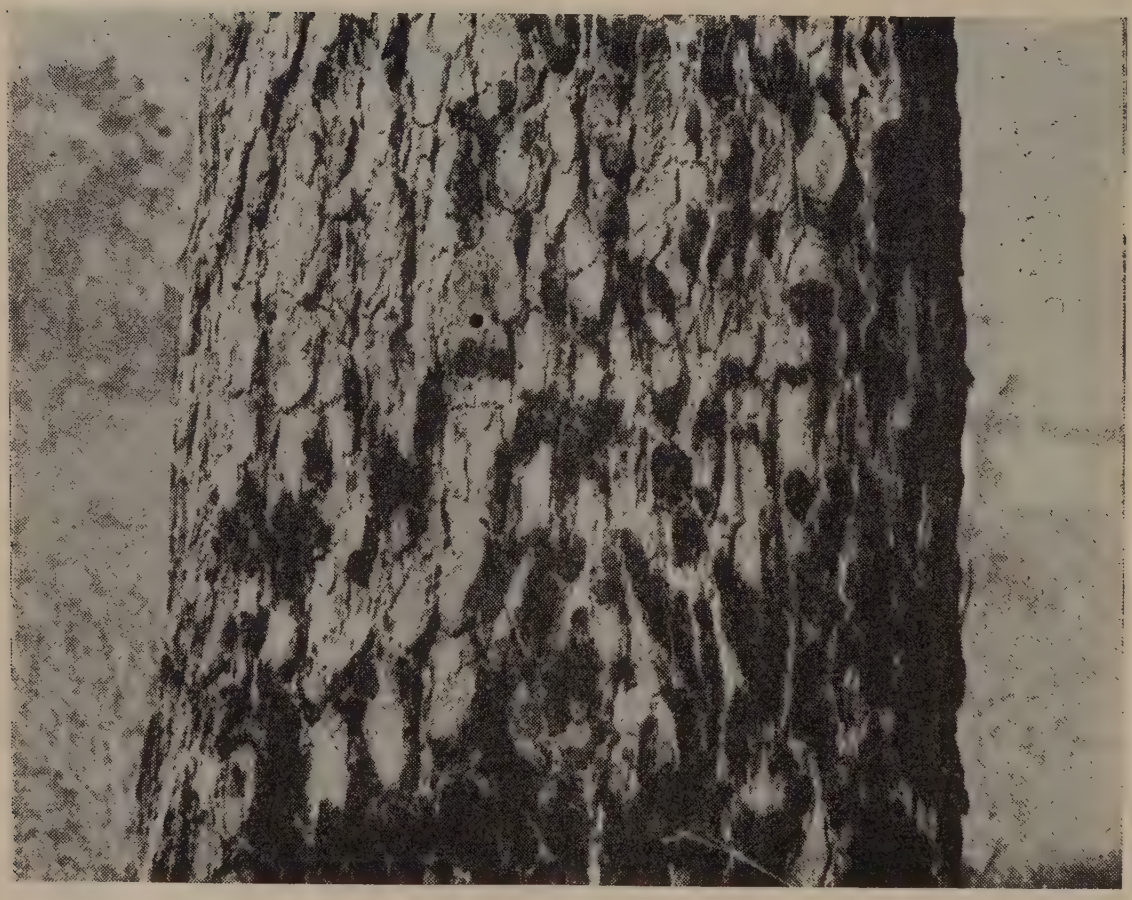


Plate 5.

Bark of Pink Bloodwood (Eucalyptus intermedia).

Among the different kinds of eucalypts, the *boxes* are recognized by a grey, rough, cracky or scaly bark (Plate 2) at least on the trunk; *ironbarks* have the well-known dark grey or black, very hard, deeply furrowed bark (Plate 3); *stringybarks* have a thick, fibrous bark (Plate 4) that can be pulled away in long shreds; *bloodwoods* have a grey, fissured, soft, flaky bark (Plate 5) that can be broken off in small, square or oblong pieces; and *gums* have smooth bark (Plate 6) that is shed each year, but there is commonly some rough, grey bark near the ground. Some eucalypts with rough bark on the lower part of the tree have smooth branches and are said to be "gum-topped" or "half-barked."

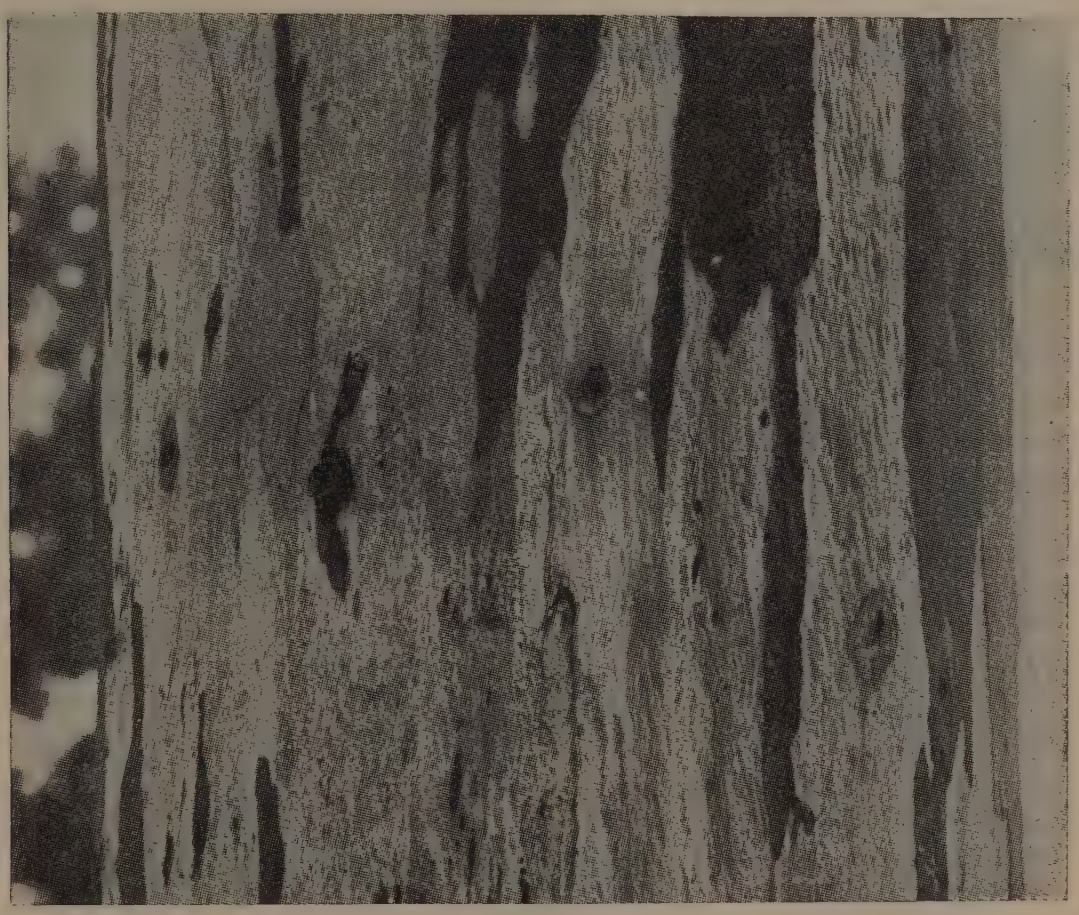


Plate 6.

Bark of Blue Gum (Eucalyptus tereticornis).

The species of *Tristania* and *Angophora* are trees similar to eucalypts in appearance, but the buds have no lid and the flowers have sepals and petals. The stamens are joined into five bundles in *Tristania* and the leaves in *Angophora* are always in pairs.

The trees of this group are valued for both their nectar and pollen.

(2) **Tea-trees.**—These are shrubs or trees belonging to the genus *Melaleuca*. The flowers appear to consist chiefly of the long cream or white bundles of stamens, and are grouped into feathery spikes or heads which often have a tuft of leaves at the top. The leaves have several principal veins running along their length, without a distinct midrib, or else they are small and narrow. *Callistemon* is very like many species of *Melaleuca* but the stamens are usually red and the leaves have a distinct midrib.

Species of *Leptospermum* are also often called "tea-trees." They are shrubs or small trees with small, usually narrow, leaves and rather small flowers. These have five rounded white or pinkish petals and short stamens.

Tea-trees produce both nectar and pollen.

(3) **Banksias.**—The species of *Banksia,* sometimes called bottle-brushes, are shrubs or small trees with hard, often toothed, leaves that are often white underneath, and dense stiff-looking spikes of yellowish or orange-coloured flowers. At first sight the flower-spikes look like those of *Callistemon* and some kinds of *Melaleuca,* but the flowers consist of four narrow, petal-like, often curved or coiled sepals, each with a single anther near the top, and a long slender style in the middle of the flower. They produce pollen and a watery type of nectar.

(4) **Wattles.**—These are species of *Acacia* and are a well-known type of shrub or tree with fluffy, yellow balls or spikes of densely packed, very small flowers having tiny sepals and petals and many longer stamens that give the fluffy appearance. They are valuable to the apiarist as pollen producers rather than as sources of nectar.

(5) **Mangroves.**—These are shrubs and trees which grow in tidal mud and produce nectar and pollen.

(6) **She-oaks.**—These trees are species of *Casuarina.* They produce an abundance of slender green twigs that are often mistaken for leaves. The true leaves are exceedingly small and appear as tiny teeth at the joints of the twigs. There are distinct male and female flowers. The male flowers, consisting of a single stamen, are grouped in orange or brown spikes at the ends of the twigs and produce pollen.

(7) **Crop plants,** such as maize and lucerne.

(8) **Weeds,** such as dandelions, thistles and wild turnip.

(9) **Miscellaneous trees,** shrubs and smaller plants.

For various reasons, no attempt will be made at this stage to treat all members of any one group together.

Yellow Box.

Botanical Name.—Eucalyptus melliodora A Cunn. ex Schau.

Other Common Name.—Yellow jacket.

Distinguishing Features.—This tree (Plates 7 and 8) can be recognized by its "half-barked" appearance, the bright-yellow inner bark, the narrow leaves with 3 slightly prominent longitudinal veins, and the usually 6-celled seed-capsules. The proportion of smooth to rough bark varies from tree to tree.

Description.—A tree up to 80 ft. high but usually much lower, with graceful weeping branches and often with a short trunk and spreading crown. The bark is persistent, grey, somewhat fibrous and wrinkled to flaky ("box"-like) on the lower part of the trunk, and bright yellow internally towards the sapwood; on the upper part of the tree it is deciduous, smooth, light grey or greenish. The leaves, on stalks $\frac{1}{3}$-$\frac{3}{4}$ in. long, are narrow, drooping, greyish green, dull, mostly $2\frac{1}{2}$-6 in. long and usually 4-12 times as long as wide, with 3 main veins—a midrib and one along each side towards the margin. The flowers are usually white, on slender stalks in clusters on main stalks amongst the leaves, about

½ in. wide when fully out; the buds are about ⅕-⅓ in. long and ⅛-⅙ in. wide, with a rounded or pointed lid about half as long as the whole bud. The seed-capsule is cup-shaped or slightly narrowed in the upper part, with usually 6 (sometimes 5) cells.

Distribution.—On light soils, chiefly in the southern part of the Darling Downs District; occasional on ranges in the Moreton and Burnett Districts. It is widely spread in the southern Australian States.

Usual Flowering Time.—October to December.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Nil.

General Remarks.—Yellow box is much sought after by beekeepers operating in the Warwick, Stanthorpe, Inglewood and Texas areas, as it is a prolific producer of quality honey. The honey is exceptionally



Plate 7.

Yellow Box (Eucalyptus melliodora). Leaves, buds and flowers.

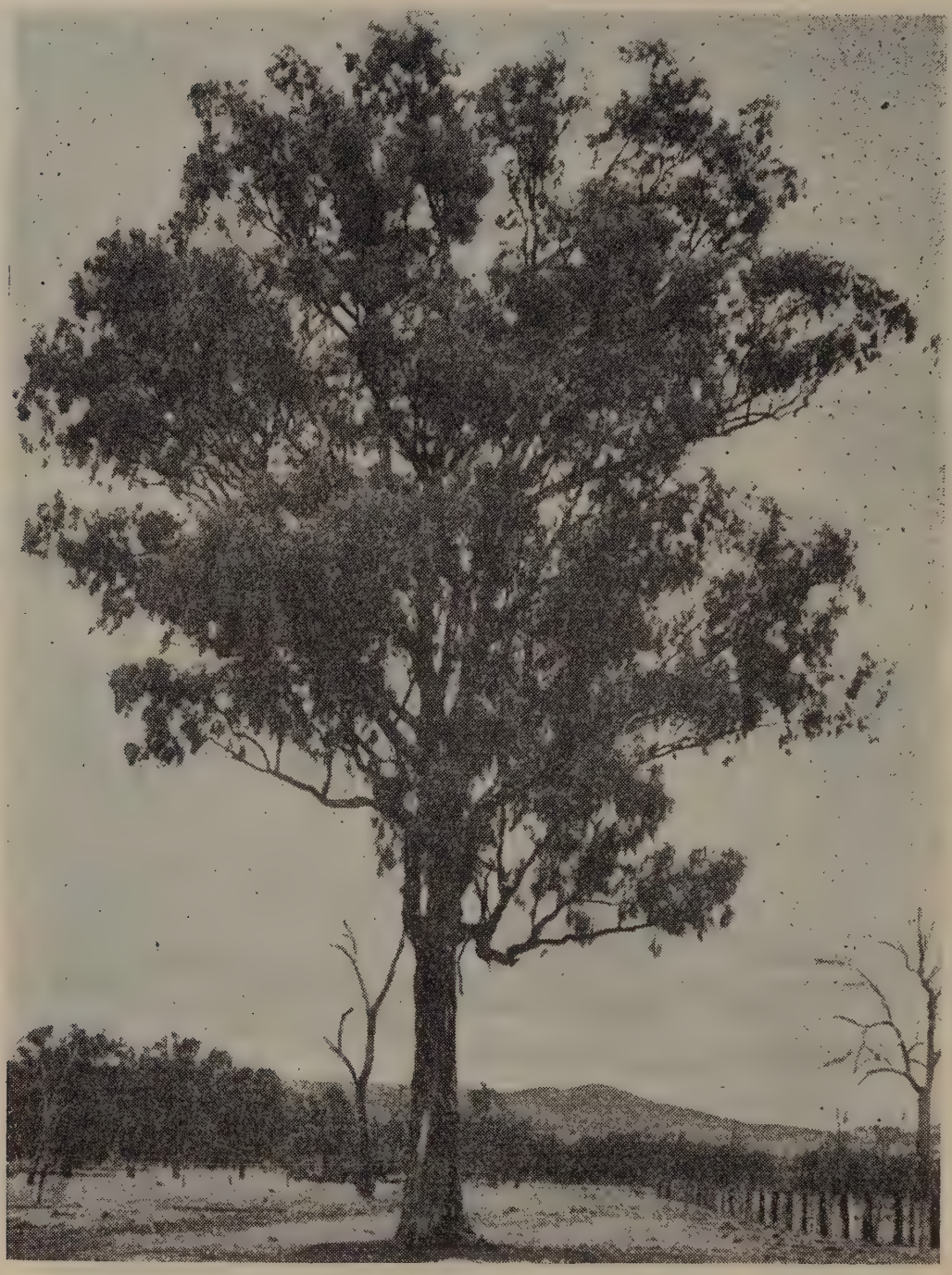


Plate 8.
Yellow Box (Eucalyptus melliodora). Waroo district.

dense, with a pronounced cloying sweet flavour, and remains liquid almost indefinitely. Unlike that of other eucalypts, the quality always remains high whether the flow of nectar is slow or quick.

Colonies occasionally lose strength when working this tree, as pollen is not obtained from it, and this results in restricted brood rearing. Fortunately, yellow box usually flowers at the same time as other pollen-producing species, and colony strength is not then impaired.

Poplar Box.

Botanical Name.—Eucalyptus populnea F. Muell., also known as *Eucalyptus populifolia* Hook. (not *Eucalyptus populifolia* Desf.).

Other Common Names.—Box, grey box, bimbil box, shiny leaf box, round leaf box.

Distinguishing Features.—This tree (Plates 2, 9, 10 and 11) is easily recognised by its typical "box" bark and broad, shining-green, twinkling leaves.



Plate 9.

Poplar Box (Eucalyptus populnea). Leaves and seed-capsules.

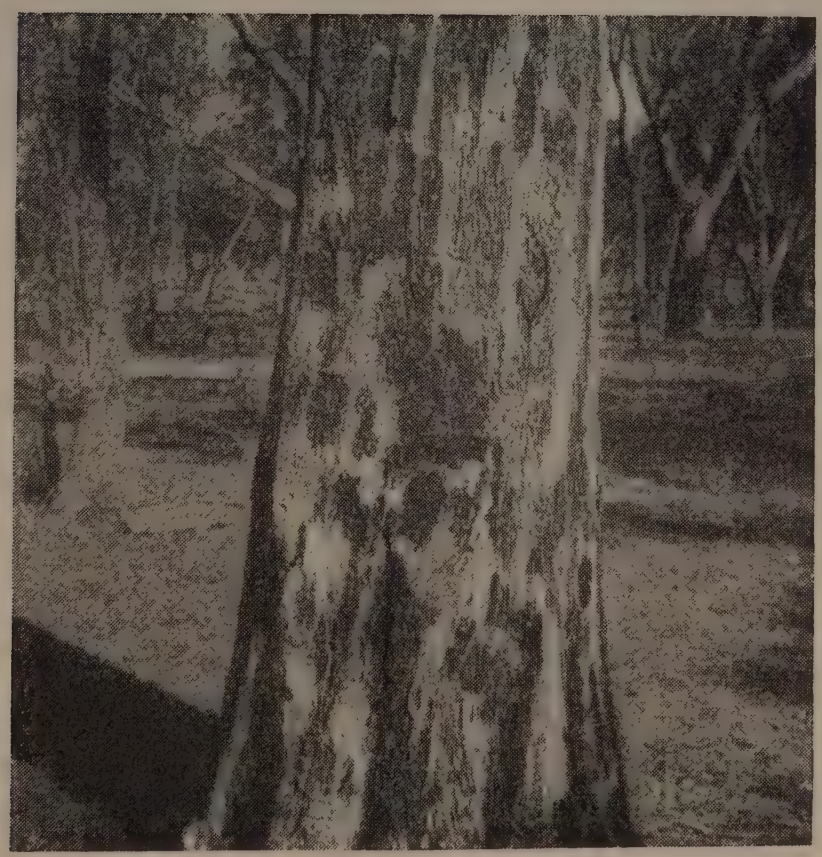


Plate 10.

Poplar Box (Eucalyptus populnea). Note the typical "box" bark on the trunk.

Description.—A tree 30-70 ft. high, with rough, grey, wrinkled or scaly bark up to the small branches (a typical "box"). The leaves are shining green, drooping on long, slender stalks of about 1 in. and twinkling in the sun; their shape is rounded or narrowed to one or both ends, as long as wide or up to $2\frac{1}{4}$ times as long as wide, mostly 2-$3\frac{1}{2}$ in. long and 1-$2\frac{1}{4}$ in. wide. The flowers are white, about $\frac{1}{6}$-$\frac{1}{5}$ in. wide, in little clusters of 5-9, the clusters on stalks at the ends of the twigs and among the upper leaves; the buds are about $\frac{1}{10}$-$\frac{1}{6}$ in. long, with a short rounded or slightly pointed lid. The seed-capsules are cup-shaped, about $\frac{1}{8}$ in. long and wide.



Plate 11.
Poplar Box (Eucalyptus populnea). Millbrook.

Distribution.—Widely spread in the Darling Downs except in the south-east, and in the western part of the Burnett district; it often forms extensive stands. The tree is also widespread in western Queensland and north-western New South Wales.

Usual Flowering Time.—December to January.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Moderate.

Importance as Source of Pollen.—Minor.

General Remarks.—This tree flowers erratically and produces a moderate crop only once every two or three years according to the season and the locality. On some parts of the eastern Darling Downs it has the reputation of being useless to the beekeeper. The honey is pleasantly flavoured and has a medium density. Poplar box often flowers in association with river red gum and the blend of these two honeys finds a ready market.

[*To be continued.*]

PLANT PROTECTION

The Occurrence of the European House Borer In Queensland.

A. R. BRIMBLECOMBE, Entomologist, Science Branch.

SMALL longicorn larvae in samples of borer-infested pine wood received in December 1952 were identified as the European house borer*. The timber had been taken from the roof structure of a dwelling built in a Brisbane suburb from a consignment of prefabricated houses which arrived from France in 1950. Further samples of damaged timber containing almost mature larvae have since been received from the same locality, and it seems therefore that this pest has become established in Australia.

Origin and Distribution.

The European house borer, as the common name indicates, is a native of Europe, and probably the original home was one of the countries bordering the Baltic Sea. It has since spread to other parts of the continent and to overseas countries. Records of occurrence are from Siberia, Russia, Finland, Estonia, Latvia, Sweden, Norway, Denmark, Germany, Holland, England, France, Spain, Italy, Cyprus, Turkey, Northern Caucasus, United States, Argentina, and South Africa.

Host Timbers and Breeding Places.

All records show that the European house borer is confined to coniferous timbers. In Europe, pines are particularly preferred, spruces being attacked to a much less extent and firs suffering only slightly. In South Africa the following pines are listed as hosts:—*Pinus apacha, P. canariensis, P. caribaea, P. halepensis, P. palustris, P. pinaster, P. pinea, P. radiata, P. sylvestris,* and *P. taeda.* The favoured species are *radiata, pinaster* and *sylvestris.*

Originally the borer inhabited the forests but now in northern Europe it is more common in cities and towns, where it breeds in the timber of houses, factories, stores, stables and other buildings, and in pine telephone poles and fences. In parts of South Africa it is also common in houses. In both countries breeding still occurs in logs, tree stumps and logging residues, as well as in dead or dying branches, but it has never been recorded in living tissue.

Symptoms of Attack and Importance of Damage.

Normally, attacks on fresh logs, stumps and dead branches are not evident, but after the lapse of several years larval tunnels may be

* Identification as *Hylotrupes bajulus L.* was provided by the Commonwealth Institute of Entomology, London.

revealed when bark is peeled away or the timber is cut. Following the normal milling routine, boards from infested logs seldom show small larval tunnels on the rough sawn surfaces and therefore attacks on structural timbers may not be evident until some pieces collapse. Regular inspections might reveal slight amounts of borer dust or the emergence holes of the first and subsequent generations, but almost invariably the infestation is many years old before it is discovered.

Attacks may occur in new buildings; however, the liability to infestation increases up to 30 years and decreases slightly after 50 years. Reinfestation occurs from succeeding generations until there is insufficient substantial wood remaining to maintain the borer. Three or four generations are passed before collapse of damaged timber is likely, but since the insect has a long life cycle, this may not occur for perhaps 25 years.



Plate 1.
Pine Timber with a Flap Turned Down to Show Damage by European House Borer.

Detailed regular inspections in Stockholm (Sweden) have shown that more than 50% of buildings are infested, while in Germany a survey of more than 130,000 houses showed 41.5% affected, and in some regions as much as 70%-80%. In South Africa, infestation of parts of Cape Town has been determined to include up to 90% of buildings. If the borer becomes firmly established in Brisbane, an economic

problem will arise in checking rate of spread and damage to dwellings in the locality of the present infestation. Spread to other localities where European pines have been used could follow, and infestation may occur in *Pinus* timbers which are being grown and used on an increasing scale in Queensland. There is also the possibility that the native pines (namely, hoop, bunya and kauri pine) may become involved and then the timber industry in this State would be faced with a major preservation problem.

Developmental Stages and Life Cycle.

The European house borer during its life cycle passes through the usual four stages—egg, larva or grub, pupa and adult.

The egg is about one-fifteenth of an inch in length, creamy-white in colour and almost oval in shape. After an incubation period of about two weeks it hatches into a small, elongate, creamy-white grub provided with transverse body folds which aid movement in the tunnel. Eventually the grub grows to a length of about an inch (Plate 2)



Plate 2.

European House Borer. Left, beetle showing ovipositor extended. Right, larva. Beetle illustration after Craighead.

before changing to the pupa. The period required for larval development is influenced by climatic conditions. In South Africa it may last from one to three years and in northern European countries from three to 11 years. The pupa is creamy coloured and about three-quarters of an inch in length. After a few weeks it changes to the adult beetle (Plate 2), which averages about half an inch in length. It is dark in colour, but appears greyish due to a pale pubescence, which is intensified on the elytra to give the appearance of four spots, while on the prothorax are two shining black prominences.

The mature beetles may not emerge from the pupal cells for several months, but as soon as they do mating occurs and egglaying follows in a few days. The whole life cycle therefore occupies an average of three years in South Africa and four or more years in northern Europe.

Habits and Behaviour.

The adult beetles are strong fliers and may disperse over a wide area. They show a tendency, however, to remain in the vicinity of the timber from which they emerged and to reinfest that timber. The females deposit the eggs singly or in small groups into cracks and crevices in the wood, preferably on rough surfaces. During the female life of about two weeks more than 100 eggs may be laid. In the cold countries of northern Europe the insect is most common in maritime areas, where it shows a distinct preference for warmed buildings or roof structures. In warmer climates infestations can occur in all parts of buildings.

Attacks are mainly on dry timber of pines, particularly those with large annular rings. In these damage is confined to the sapwood, which, however, constitutes the bulk of the wood produced during the first 20 or 30 years of growth. The food of the grubs consists chiefly of digested cell walls.

Young grubs prefer to tunnel across the grain in spring tissue of new growth, and the older grubs work mostly along the grain, damaging both spring and autumn wood. The tunnels are filled with loose granular borer dust and may be a quarter of an inch across. When full-grown the larvæ approach the surface and then penetrate deeper to make the pupal cells. The emerging beetles therefore easily reach the exterior surface, where they leave the typical small oval emergence holes. Since the insect has a long larval life, during which tunnelling is almost continuous, the number of emergence holes may not give a true indication of the amount of internal damage, or even the extent of the infestation in a building.

Control.

Control measures attempted in overseas countries have involved fumigation, which appears to have been discontinued, roof heating and the application of preservative materials. Roof heating, with oil or coke burners, to a temperature averaging about 150°F. for 12 hours has been successful in killing all stages of the borer, but reinfestation can occur. Preservatives have been used to check damage in infested timbers and to protect non-infested timber. With these older methods complete control has not always been achieved, and more recent experiments have been directed towards immunising timber by an impregnation treatment, though recommendations for commercial use have not been finalised.

Where European pine timbers have been used in Queensland it is especially urged that inspections should be made for signs of European house borer damage. If any are found the affected timber should be removed and destroyed or given a liberal application of 5% pentachlorophenol in dieseline oil. Regular inspections should then become routine practice, with further chemical treatments as required.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 27th APRIL, 1953.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth W. Henschell, " Yarranvale," Yarranlea Con. O'Sullivan, " Navillus Stud," Greenmount H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy Sullivan Bros. " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer " Stud, Wondai W. G. Marquardt, " Springlands," Wondai A. C. and C. R. Marquardt, " Cedar Valley," Wondai A. H. Sokoll, " Sunny Crest " Stud, Wondai W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman W. H. Thompson, " Alfa Vale," Nanango
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain " St. Christopher's and Iona " Studs, Brookfield road, Brisbane E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount J. F. Lau, " Rosallen " Jersey Stud, Goombungee G. Harley, Hopewell, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, " The Craigan Farm," Aspley R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood E. A. Matthews, " Yarradale," Yarraman A. L. Semgreen, " Tecoma," Coolabunia G. & V. Beattie, " Beauvern," Antigua, Maryborough L. E. Meier, " Ardath " Stud, Boonah A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango F. W. Verrall, " Coleburn," Walloon
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 27th APRIL, 1953.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Hillcrest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White	O. H. Horton, Manneum, Kingaroy
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	P. V. Campbell, Lawn Hill, Lamington
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
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	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
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ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	8	50	Longreach	26	43
6	6.32	5.00	Charleville ..	25	29	Quilpie	37	33
11	6.34	4.59	Cloncurry	36	63	Rockhampton ..	1	19
16	6.36	5.00	Cunnamulla ..	31	27	Roma	15	19
21	6.38	5.00	Dirranbandi ..	22	16	Townsville	8	42
26	6.39	5.2	Emerald	11	28	Winton	29	52
30	6.39	5.3	Hughenden ..	21	49	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	8.21	9.34
2	9.27	10.18
3	10.32	10.58
4	11.35	11.35
		p.m.
5	..	12.10
	a.m.	
6	12.38	12.45
7	1.41	1.21
8	2.46	1.59
9	3.52	2.43
10	4.58	3.31
11	6.02	4.25
12	7.02	5 24
13	7.55	6.24
14	8.42	7.23
15	9.22	8.21
16	9.57	9.17
17	10.28	10.10
18	10.58	11.02
19	11.26	11.54
20	11.54	..
	p.m.	a.m.
21	12.24	12.46
22	12.56	1.40
23	1.33	2.36
24	2.15	3.35
25	3.04	4.35
26	4.00	5.35
27	5.02	6.33
28	6.09	7.27
29	7.17	8.14
30	8.23	8.57

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	27	11	43	26	18	1	51	29
6	19	21	34	37	10	12	39	43
11	10	30	35	44	0	20	27	53
16	14	24	29	40	4	15	33	46
21	23	15	39	31	14	7	45	35
26	30	9	46	24	21	0	53	26
30	24	14	40	29	15	4	46	33

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	48	7	63	35	48	21	40	8
3	39	16	56	41	41	26	33	15
5	27	28	49	49	33	34	23	24
7	21	39	44	57	29	42	18	34
9	11	49	38	63	23	49	10	41
11	5	53	35	66	19	51	5	44
13	5	52	35	65	19	50	5	44
15	12	45	38	60	23	46	11	37
17	20	36	44	55	29	40	18	31
19	30	26	51	47	35	33	25	22
21	39	21	56	44	41	29	33	18
23	47	11	63	38	47	23	39	11
25	54	5	67	34	51	20	44	6
27	54	4	67	33	51	19	44	5
29	45	10	61	37	46	23	37	10
30	41	15	57	41	42	26	34	14

Phases of the Moon.—Last Quarter, 5th June, 3.35 a.m.; New Moon, 12th June, 12.55 a.m.; First Quarter, 19th June, 10.01 p.m.; Full Moon, 27th June, 1.29 p.m.

On 22nd June the sun will reach its greatest angle north of the equator. It will then rise about 25 degrees north of true east and set 25 degrees north of true west. On the 5th and 19th the moon will rise and set approximately at true east and true west respectively.

Mercury.—An evening object all this month, reaching greatest angle east of the sun on the 27th. On the 1st, in the constellation of Taurus, it will set 28 minutes after the sun, and after passing Mars on the 2nd and Pollux on the 21st, at the end of the month, in the constellation of Cancer, will set about 2 hours after the sun.

Venus.—At the beginning of the month, in the constellation of Pisces, will rise 3 hours 20 minutes before the sun and on the 23rd will reach greatest angle west of the sun. By the end of the month, in the constellation of Taurus, will rise 3 hours 30 minutes before sunrise.

Mars.—Still too close in line with the sun to be seen.

Jupiter.—May be seen low in the east at morning twilight during this month. On the 21st it will pass close to Aldebaran and at the end of the month, in the constellation of Taurus, will rise nearly 2 hours before the sun.

Saturn.—In the constellation of Virgo, at the beginning of the month will set between 2.50 a.m. and 4.00 a.m. and at the end of the month will set just after midnight.

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C. W. WINDERS, B.Sc.Agr.



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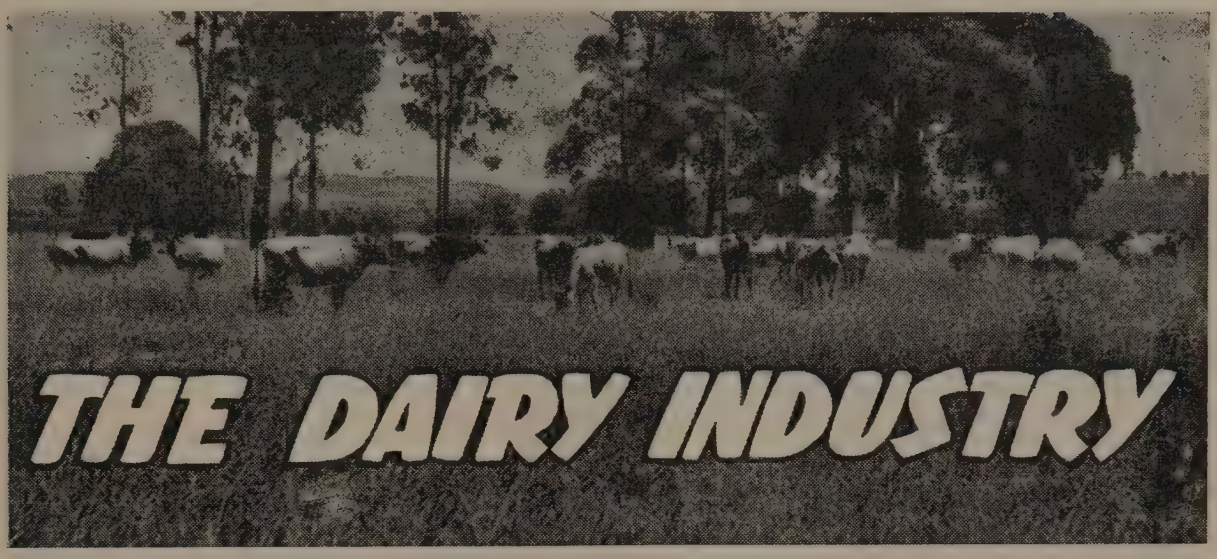
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Dairy Farming on the North-Eastern Darling Downs.

P. ROUND, Senior Adviser in Cattle Husbandry.

THE dairying industry on the Darling Downs has grown from small proportions into a major industry, and the mechanisation of dairy farming has made rapid progress during the past 15 years. Prior to mechanisation, dairying was carried on with family labour, and was the means whereby many families, with little capital, were enabled to commence farming on their own account.

Small proprietary butter and cheese factories were erected throughout the Downs in the early years of the industry and milk and cream were transported by individual farmers in horse-drawn vehicles, or in wet weather, often by pack-horse. As the industry developed, co-operative factories were started and mechanisation was introduced to the factories and dairies. With the improvement of roads and road transport, many small factories were closed and a swing to centralised factories took place, the object being to reduce manufacturing costs and improve manufacturing methods as well as the quality of the produce.

Although a large proportion of the State's cheese is still produced on the Downs, many dairymen have diverted their supplies to butter and pasteurised milk in recent years. Much Downs milk is being supplied to Brisbane for household use and processing into ice cream and other milk products. This is carried by road in fast motor tankers.

Although some suppliers still transport their own milk and cream to the factories, most areas are well provided with organised services by carriers who collect the product at the farm and convey it by motor transport direct to the factory. A small proportion is still carried by rail.

Factories are well equipped with sufficient modern machinery to handle a much greater supply of raw material than is available.

Most dairy farms are equipped with milking machines, and have tractors with sufficient complementary machinery to perform all necessary operations.



Plate 1.

Sketch Map of the North-eastern Darling Downs.

A progressive stud industry has assisted materially in raising the production potential of dairy cattle on the Downs, and milk production is limited not so much by the production capacity of the cows as by the feed available.

Fodder for cows varies in both quality and quantity from month to month and frequently it is below the requirements for normal production. This is particularly serious at times when cows are in the early stage of lactation.

The *Queensland Agricultural Journal* of October 1897 records a statement by the late John Mahon (Government Dairy Expert) which reads as follows:—

"We are only too well aware of the fact that in this colony, as is the case in all the Australian colonies, we have dry seasons periodically, and during a period of the year the natural pasturage is unreliable, and in consequence the cows go off their milk and become reduced to such a low state of poverty that, when the next season comes on, the animal, instead of producing milk, requires all the food given her to build up her weak constitution, and is unprofitable to the dairyman.

"A little knowledge in feeding and a small amount of extra labour would be the means of placing thousands of pounds that are now being lost in the pockets of the Australian dairymen each year.

"There can be but one opinion as regards the urgent necessity of adopting better methods of feeding, sheltering, and treatment of our dairy herds, and it behoves every person engaged in the business to give special attention to these matters. The slipshod method of allowing the animal to provide for herself has passed long ago. It must be apparent to all observant persons that our dairymen have not yet risen to the fact that success in dairying is dependent on the breeding, feeding, and treatment of dairy cattle. We can no longer afford to waste food and labour on cows that will yield a few pints of milk daily. The yield of milk per cow is of the greatest importance to dairymen, and until raised to a higher standard we may expect to hear of unprofitable results from those engaged in the business. The most essential point, and one which demands the immediate attention of all dairymen in this colony, is to reduce the cost of milk production, which must be done to place ourselves on equal footing with dairymen in other parts of the globe.



Plate 2.

Dairying is Conducive to Longevity. The driver is 72 years old, the horse 30 years.

"The object of every dairyman should be to obtain a maximum flow of milk at the lowest cost. A 'Babcock' milk-tester should be kept in use, and the animal that will not pay for her food and labour in milking should be no longer kept in the herd. By judicious culling, carried out by the aid of the 'Babcock' tester, the standard of our herds could be raised very considerably. Too much stress cannot be laid on the necessity of testing each cow. Feeding inferior cattle is ruinous."

This message of 55 years ago is still largely true, and where dairymen cannot or do not provide sufficient food and feed it to cows with a high production potential, production of milk per acre must remain low.

In this article, dairying in the local authority areas of Pittsworth, Cambooya, Clifton and Toowoomba is dealt with, as these portions of the Downs are somewhat similar in topography, soils and vegetation.

CLIMATE.

Generally speaking, the eastern portion of the area under discussion has a slightly better rainfall than the western part. This is indicated by Table 1.

TABLE 1.

METEOROLOGICAL DATA FOR TOOWOOMBA AND PITTSWORTH.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average
						TOOWOOMBA.							
A.	81·6	80·5	77·8	73·7	67·1	61·8	61·1	64·5	70·8	76·1	80·4	82·5	73·2
B.	60·7	60·9	58·3	52·5	46·2	42·5	40·2	41·6	46·9	51·8	56·4	59·5	51·5
C.	506	451	381	254	219	252	203	169	214	257	319	431	3,656
						PITTSWORTH.							
A.	85·7	84·7	81·8	76·5	68·5	62·8	61·6	65·4	72·4	78·9	84·1	85·8	75·7
B.	62·4	61·7	59·2	53·8	47·0	43·5	41·2	42·8	48·2	53·6	58·6	61·2	52·8
C.	387	315	319	152	143	185	177	124	166	216	270	349	2,803

A = Mean maximum temperature ; B = Mean minimum temperature ; C = Average rainfall in points.

The mean maximum and minimum temperatures for Toowoomba and Pittsworth are based on 25- and 23-year records, respectively, and rainfall averages on 59- and 44-year records.

Storm rains, which provide about half the annual rainfall during the summer, are erratic, and dry spells of two or more months' duration, usually accompanied by heat waves, are not uncommon.

Winter rainfall is also unreliable, although of a more general nature.

TOPOGRAPHY, SOILS, AND VEGETATION.

The city of Toowoomba and the eastern portions of the shires of Cambooya and Clifton are situated on the western slopes of the Great Dividing Range. Consequently, the country consists of ridges and valleys running out into the plain country of the western portion of the two shires and the shire of Pittsworth.

A large variety of soil types are found, ranging from the steep stony ridges with brown and chocolate soils to black soils on flats and plains and the red loamy soils of the extreme eastern and north-eastern fringe.

The undulating country around Toowoomba comprises open eucalyptus forest and red loam soils formed from basalt. The soils derive their colour from the free iron oxide formed during the process of weathering. They are free-working and permeable, fairly fertile, but not as fertile as black soils nor with the same moisture-holding capacity.

A black soil which is shallower than the black soil of the open Downs exists on the undulating and hilly country of the eastern and north-eastern Downs. It is a fertile soil, well supplied with plant food.



Plate 3.

Stud Masters Appreciate the Value of Rugging High Producers in Cold Weather.

The country is open forest, timbered with gums, stringy-bark, box and ironbark. Much of it has been cleared and cultivated for many years and has now become subject to erosion. Steps are being taken by the soil conservation service of the Department to counter this and an increasing number of farmers are becoming soil conservation conscious.

The open plains of the Downs proper consist of self-mulching black soils, devoid of timber and grassed principally by Queensland blue grass (*Dichanthium sericeum*) and pitted blue grass (*Bothriochloa decipiens*). The soils are fairly well supplied with organic matter and the major mineral plant foods, lime, phosphate and potash. Owing to their high clay content, these soils retain moisture very well and once crops are established growth is reasonably well assured if ample subsoil moisture has been stored.

Although good production can be obtained from the flat and treeless plains, they present difficulties to the dairyman, as cattle suffer from weather conditions in both summer and winter. In wet weather, the paddocks and yards become very boggy, causing great discomfort for the cattle and the dairyman. This condition can, of course, be overcome by having yards and lanes raised with gravel. Shade from the sun and shelter from cold winds can be provided by planting appropriate trees.

Fertilizers and other soil requirements are not greatly used, but a number of farmers are beginning to plant legumes in an effort to improve soil fertility.

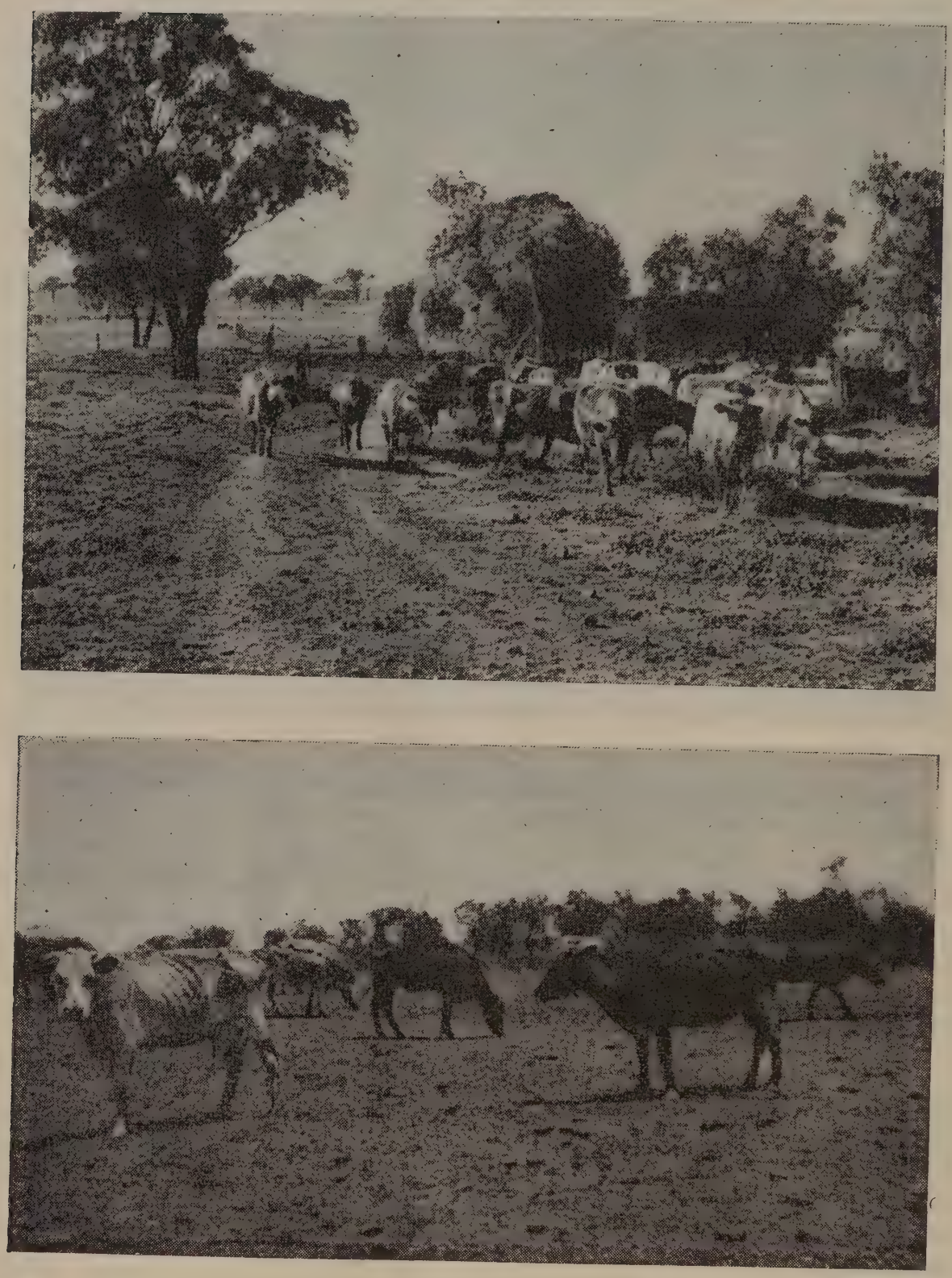


Plate 4.

Good Husbandry Pays on the Dairy Farm. Top; a herd provided with ample water, food, shade and shelter walks contentedly to the bails. Bottom, a starved herd stands about waiting for death.

WATER FACILITIES.

A few natural watercourses such as creeks exist, but the principal water supply of this area is obtained from sub-artesian bores. Good stock water can be obtained at depths ranging from 50 ft. to 400 ft. and most dairy farms have bores. These are usually equipped with windmills and troughs. Electrically driven pumps are replacing windmills on a few farms.

Although the sub-artesian water is usually suitable for stock, it is often unsuitable for irrigation and difficulties are sometimes experienced when it is used for cleaning dairy utensils because the water is hard. The latter condition can mostly be overcome by the use of approved softeners.

PASTURES.

Native pastures consisting of Queensland and pitted blue grasses predominate, but love grass, kangaroo grass, oat grass and native millets are also widely dispersed. These are mainly summer grasses. Under intensive grazing conditions they tend to become eaten out, being replaced by inferior varieties, but controlled grazing overcomes this.

Prairie grass, burr medic and various herbage plants grow prolifically in wet winters and springs but make little growth in dry winters.

Many varieties of grasses have been tried on the Downs in an endeavour to provide permanent pastures, but owing to the erratic rainfall and hot dry spells, complete success has not yet been achieved. Mixtures of Rhodes grass and lucerne, green panic and lucerne, and buffel grass and lucerne seem to offer the most promise. Urochloa grass makes a very good summer pasture but requires an early wet spring with good following rains to ensure growth. In some areas it is viewed with disfavour, as it can interfere with cultivation.

To ensure continuous grazing and profitable dairying, cultivation is necessary, and most dairying is carried on by grazing the herd on crops. The grass country is generally reserved for dry cows and heifers, which thrive quite well on it in normal seasons. In adverse seasons, progressive dairymen supplement the grass with crop or grain, thus "steaming up" the springers prior to calving.

The areas of natural pasture also provide a supplement of roughage to be grazed in conjunction with succulent crops, protecting milking cows from metabolic and digestive upsets.

CROPS FOR GRAZING.

Summer Crops.

Sudan grass and sweet sorghum are grown extensively, and provide a large bulk of nutritious grazing. Although these crops are low in protein when maturing, dairy cows produce reasonably well on them when grazed in the young and growing stage. By growing Poona pea in conjunction with the crop, the fodder value of these crops can be improved and the soil fertility will be raised.

Varieties of the millet family are also extensively grown and provide good dairy feed.

Lucerne is grown to some extent but the irregular seasonal conditions experienced preclude this from being a main crop for grazing dairy cows in this part of the State.

Maize is grown on the eastern fringe but has largely been superseded by sorghums in the western and drier portion of these shires.



Plate 5.

Well Reared Calves Have a Much Better Chance of Becoming Profitable Producers Than Neglected Youngsters.

Winter Crops.

Oats, wheat and barley are usually grown for winter feed and in favourable seasons some grain can usually be harvested in addition to grazing.

Legumes such as Golden vetch and Grey and Dun field peas are sometimes planted with cereal crops for winter grazing to increase the nutritive value and improve soil fertility. Where a crop is intended for grain after a preliminary grazing, vetches or peas should not be planted, as they may interfere seriously with harvesting.

Planting and growth are largely controlled by weather conditions, but in average seasons a continuity of grazing can be achieved by planting both summer and winter crops at judicious intervals. Sorghum planted in late summer gives a good stand of roughage for winter grazing in conjunction with oats or other cereals.

The grazing of crops, although necessary for profitable dairying, may cause severe illness or death unless properly controlled. Sorghum at a young stage of growth or in its second growth often contains dangerous levels of prussic acid. Lucerne will frequently cause bloat. Cereals may cause milk fever, grass tetany and other troubles due to mineral imbalance.

Controlled feeding will usually prevent the occurrence of these troubles. Hungry cattle should never be turned into a suspected crop. Efforts should be made to first fill them with hay, grass or other roughage. Cattle unaccustomed to sorghums should have access to the crop only when it is mature or semi-mature. A supply of photographic "hypo" should be kept on hand for drenching any cows which become affected.



Plate 6.

A Dairy Herd Grazing on Oats. The adjoining paddock is fallowing for a summer fodder crop. The timbered ridge provides shade and shelter, as well as natural grasses which help to balance the diet.

Lucerne appears to be more dangerous when young and succulent. Here again, hungry cattle should be first fed on dry or semi-dry roughage. Strip grazing by the use of temporary fences is also desirable, as animals are thus compelled to eat a fair proportion of stalk to leaf. Suitable drenches, a trocar and cannula, and constant vigilance are necessary adjuncts to lucerne grazing.

Cereals in a lush stage of growth should always be grazed in conjunction with mature grass or other mature crop such as sorghum. Failing these, a ration of hay should be fed. This practice also prevents scouring.

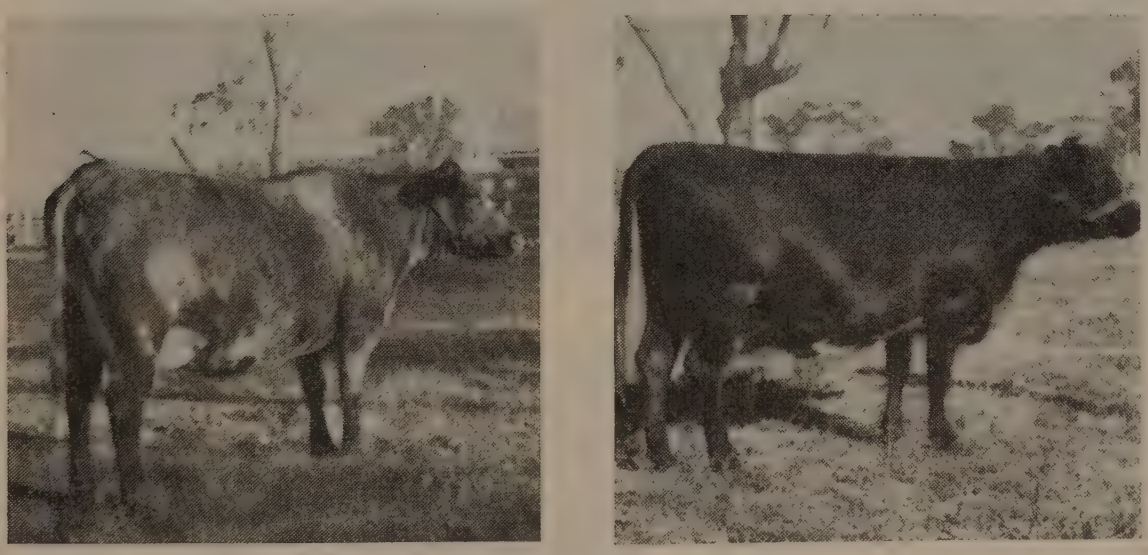


Plate 7.

Cows Steamed Up Prior to Calving Get Away to a Good Start.

NOXIOUS WEEDS.

The main noxious weeds in the area are Bathurst burr, Noogoora burr, lantana, thornapple, purple top, variegated thistle, khaki weed, Mexican poppy, galvanised burr, Scotch thistle, African boxthorn, capeweed, blueweed, saffron thistle and Paterson's curse.

Many of these can now be controlled by spraying, and except in a few cases, little loss of production is occasioned by noxious weeds.

FODDER CONSERVATION.

A prerequisite to full production in dairy cattle is that the cow should have access to all the good roughage she can eat during her lactation period. Dairying on the north-eastern Downs depends chiefly on the production of green crops for fodder, but there are times in every year when there is a scarcity of fodder because one crop is eaten out and the next is not yet ready to graze. In this area, therefore, the conservation of feed, particularly roughage, to be fed at these times of scarcity is essential if full production is to be maintained.



Plate 8.

Waiting for Water. Production is lowered when stock do not have free access to water.

Very few dairy farmers conserve fodder, taking the view that in the average season it is not required. For many years labour on dairy farms has been scarce, and normal farm operations absorb all available labour.

In seasons of average rainfall, farmers are fully occupied in cultivation and planting operations between milkings and they claim, with some justification, that time spent on fodder conservation could be better employed in planting other crops. This is probably true during seasons of plenty, but unfortunately the odd season occurs when crops do not grow. A reserve of fodder is then essential if production is to be maintained or stock kept alive. The purchase of fodder in drought years is always uneconomical. On the other hand, the loss of stock is not only uneconomical for the individual owner but has a disastrous effect on the food supply and economy of the country.



Plate 9.
The Fertile Downs Grows Good Hay.



Plate 10.
A Good Stand of Oats Provides Succulent Feed for Winter Grazing.

Fodder conservation is definitely essential, but in the past has provided many pitfalls. Losses of conserved fodder through inadequate protection from the elements and rodents has often nullified the efforts of the farmer. It is useless to spend money and labour storing surplus crops unless the feed can be conserved long enough to be of use in a dry period. Consequently, provision must be made for adequate storage. Hay can be stored with little loss of nutrients if effectively protected from the weather and rodents.

Hay.

In the area at present being dealt with, the principal hay crops are sorghums, cereals and lucerne.

Sorghum for hay is usually cut when the grain is forming, and as anything up to 30 tons of green feed per acre can be grown it provides a valuable crop. The usual method is to harvest with a reaper and binder, the sheaves then being stooked. Depending on weather conditions, the sheaves are cured in stooks for periods ranging from 6 weeks to 12 weeks before stacking is commenced, the stacks being built on raised platforms provided with mouse baffles. If properly stacked, sorghum hay has been known to keep in good condition for periods exceeding 14 years.

This hay, when it contains a fair proportion of grain, constitutes a good maintenance ration. A disability in curing sorghum for hay is caused by having the stooks in the paddock for long periods. This precludes the use of stubbles for grazing, or alternatively delays subsequent cultivation. This disability could, of course, be overcome by carting the sheaves off the paddock and stooking in an enclosed area near the stack yard, but double handling is thus incurred.

The costs of growing and conserving crops varies very widely on different farms and in different localities.



Plate 11.

Sweet Sorghum, Whether Used for Grazing, Hay or Silage, Provides a High Tonnage of Feed.

The following tables of costs taken from Downs farmers' accounts in 1950 give some indication of actual costs and will provide a guide to present and prospective dairymen.

In evaluating the cost of conserved fodder, where *surplus crop only is harvested*, the cost of *growing* need not be considered. If a farmer plants sufficient crop to feed his herd in a normal season, he has a surplus in a good season which if conserved, and fed in lean years, will stabilise production.

Sorghum Hay.

The following costs of growing, binding, carting and stacking sorghum hay are based on a conservative yield of six tons per acre. The plant required for haymaking consists of a maize binder or reaper-binder, a tractor and a motor truck. Three men are required to operate the plant, and they would cut, cart and stack the produce from two acres (12 tons) in one day. The capacity of the maize binder is half an acre per hour.

COST OF MAKING SORGHUM HAY.

GROWING COST PER ACRE.

	£	s.	d.
Wages	1	13	0
Stores	0	8	0
Repairs and Replacements	0	11	0
Tractor Fuels at 2s. per gallon	0	6	1
Petrol at 4s. 2d. per gallon	0	1	8
Oils and Grease	0	1	5
Sorghum seed at 7d. per lb. (18 lb. per acre)	0	10	6
General Expenses (Overhead)	0	1	8
Depreciation	0	13	7
Insurance, Pay Roll Tax, Shire Rates, Land Tax, Workers' Compensation	0	4	8
Interest on Capital Outlay and Improvements at 4 per cent.	0	5	9

COST OF BINDING, CARTING AND STACKING PER ACRE.

Wages and Keep	3	0	0
Tractor Fuel	0	10	0
Fuel and Running Expenses of Truck	1	6	0
Binder Twine	0	10	0
Depreciation on Plant	1	0	0
Total Cost of Making Sorghum Hay per Acre	11	3	4
Total Cost of Making Sorghum Hay per Ton	1	17	3

Cereal Hay.

Oats and wheat are the two main cereal crops used for hay. They are cut with a reaper and binder when coming into head and stooked. As they give lighter crops than sorghum, curing takes less time and stacking can be carried out much sooner. Where side-delivery rakes and pick-up balers are available, these crops can be baled. Here again, if grain is present, care must be taken to protect the stacks against rodents. Good wheat and oaten hay also provide a good maintenance ration for cattle.

In the absence of green feed, the feeding of hay only requires the addition of salt and some other laxative food to the ration to avoid digestive upsets. Where cereal or sorghum hay alone is used, access to a salt and ground limestone lick should be given.

COST OF MAKING OATEN HAY.

GROWING COST PER ACRE.

	£	s.	d.
Wages	1	13	0
Stores	0	8	0
Repairs and Replacements	0	11	0
Tractor Fuels at 2s. per gallon	0	6	1
Petrol at 4s. 2d. per gallon	0	1	8
Oils and Grease	0	1	5
Oats seed at 17s. per bushel (1¼ bushels per acre)	1	1	3
General Expenses (Overhead)	0	1	8
Depreciation	0	13	7
Insurance, Pay Roll Tax, Shire Rates, Land Tax, Workers' Compensation	0	4	8
Interest on Capital Outlay and Improvements at 4 per cent.	0	5	9

COST OF HARVESTING BY CONTRACT PER ACRE.

Mowing	0	5	0
Raking	0	2	0
Baling at 1s. 8d. per Bale (Estimate of 46 Bales)	3	16	8
Total Cost of Making Oaten Hay per Acre (30 cwt.)	9	11	9
Total Cost of Making Oaten Hay per Ton	6	7	10

Lucerne Hay.

Where lucerne can be profitably grown, it provides the best hay, as it contains all the required nutrients. It is actually higher in protein than a maintenance ration requires.

The advent of the pick-up baler and side-delivery rake has simplified haymaking, and both lucerne and cereal crops can be readily handled by these machines. Baled hay can also be stored more compactly than loose hay, thus reducing the possibility of damaging and economising on shed space. Such machines are usually too costly for individual farmers, but by co-operative effort much can be done. In some cases contractors undertake the operations of mowing, raking, baling and carting. Consequently, if a farmer grows a crop he can have it conserved at a very small cost. Lucerne hay has the added advantage that it carries no grain and is not so attractive to mice. Very little lucerne hay is made on the north-eastern Downs for feeding back to dairy cows: most of the hay which is made is sold as a cash crop.

Silage.

Very few farms are equipped with silos and the few tower and pit silos which do exist are seldom used. During every minor or major drought, farmers' thoughts turn to fodder conservation, but when it rains the urge disappears, and under the pressure of other work, fodder conservation is deferred indefinitely. On the other hand, while the fear of drought still exists fodder is frequently hurriedly conserved without adequate protection.

For some years, many dairymen made sorghum silage in trenches. This proved to be quite economical and satisfactory, but the practice fell into decline through lack of labour during the war years and subsequent good seasons gave farmers a sense of false security.

At the present time very little silage is made, but sorghum is the most suitable crop for this purpose. If legume crops such as lucerne and Poona peas are ensiled with sorghum, a good balanced ration can be made. Silage fed when other feeds are dry and fibrous helps to prevent impaction.

Sweet Sorghum Silage.

The following costs of growing and ensiling sweet sorghum are based on a normal yield of 12 tons of green material per acre. The plant required for binding, carting and ensiling comprises a maize binder or reaper-binder, a tractor and a motor truck, with three men to operate the plant, cutting, carting and ensiling 24 tons of green material per day. Twelve tons of ensilage occupies a space of 720 cubic feet; taking the cost of excavating the trench silo by contract as 2s. 6d. per cubic yard, the excavation required for 12 tons would cost £3 6s. 8d.

COST OF MAKING SWEET SORGHUM ENSILAGE.

GROWING COST PER ACRE.

	£	s.	d.
Wages	1	13	0
Stores	0	8	0
Repairs and Replacements	0	11	0
Tractor Fuels at 2s. per gallon	0	6	1
Petrol at 4s. 2d. per gallon	0	1	8
Oils and Grease	0	1	5
Sorghum seed at 7d. per lb. (18 lb. per acre)	0	10	6
General Expenses (Overhead)	0	1	8
Depreciation	0	13	7
Insurance, Pay Roll Tax, Shire Rates, Land Tax, Workers' Compensation	0	4	8
Interest on Capital Outlay and Improvements at 4 per cent.	0	5	9

COST OF BINDING, CARTING AND ENSILING PER ACRE.

Wages and Keep	3	0	0
Tractor Fuel	0	10	0
Fuel and Running Expenses of Truck	1	6	0
Binder Twine	0	10	0
Depreciation on Plant	1	0	0
Cost of Excavating Trench Silo (Contract)	3	6	8
Total Cost of Making Sweet Sorghum Ensilage Per Acre	14	10	0
Total Cost of Making Sweet Sorghum Ensilage Per Ton	1	4	2*

* Plus cost of covering with soil.

Grain.

Sorghum and winter cereal grains grow well in most of the area, and maize can be grown in the better rainfall portion near the range.

A few farms are equipped with tanks for grain storage; by this means grain can be kept in good condition for many years. The majority of dairymen, however, use grain as a cash crop and dispose of it immediately after harvesting. Grain is such a concentrated form of food that it is well suited to conservation as a drought relief fodder. Six months' maintenance ration could well be conserved on each farm, and if not required, sold when a new crop is assured. Any loss of weight thus incurred would be cheap insurance.

The few farmers who make provision for using grain as a supplement ration during normal dry spells find that it pays by keeping their stock in condition and maintaining production, thus enabling them to continue production when other feed becomes available.

COST OF OATS FOR GRAIN.

GROWING COST PER ACRE.

	£	s.	d.
Wages	1	13	0
Stores	0	8	0
Repairs and Replacements	0	11	0
Tractor Fuels at 2s. per gallon	0	6	1
Petrol at 4s. 2d. per gallon	0	1	8
Oils and Grease	0	1	5
Oats seed at 17s. per bushel (1¼ bushels)	1	1	3
General Expenses (Overhead)	0	1	8
Depreciation	0	13	7
Insurance, Pay Roll Tax, Shire Rates, Land Tax, Workers' Compensation	0	4	8
Interest on Capital Outlay and Improvements at 4 per cent.	0	5	9

COST OF HARVESTING PER ACRE.

Labour	0	3	8
Bags (10 at 6s. 8d. each)	3	6	8
Twine	0	0	6
Machinery, Fuel, &c.	0	5	0
Total Cost of Growing and Harvesting Oats Per Acre	9	3	11
Total Cost of Growing and Harvesting Oats Per Bushel (at 30 bush. Per Acre)	0	6	2

TYPE OF DAIRYING.

For many years cheese production predominated in this area, but a gradual swing to cream and processed milk has taken place, although a considerable amount of milk is still used for cheesemaking.

Cheese factories operate at Toowoomba, Ramsay, Barnsmore (Sugarloaf), Greenmount, Felton East, Rockview, Pittsworth, Linthorpe, Mount Tyson and Irongate.

Butter factories are established at Toowoomba and Clifton, and two pasteurised milk factories at Toowoomba supply a considerable amount of milk to the Brisbane milk and ice-cream trade.

Pig raising is mainly carried out as a sideline on dairies supplying cream to butter factories or milk to cheese factories, thus utilising separated milk and whey.

Cash crops of grain sorghum, wheat, oats, barley, canary seed and linseed are also grown extensively on many dairy farms, and owing to the ease of cashing grain crops, a tendency has developed among some farmers to utilise the dairy herd as scavengers rather than the means through which the crop is sold. A more equitable balance between the value of milk per acre and grain per acre is gradually remedying this.

On the larger farms a considerable number of heifers are raised, the surplus above herd replacements being sold to dairymen who have insufficient country to rear any young stock. The greatest number of calves are, however, sold as bobbies, for which there is a steady demand by meatworks operators.

Culled cows are sold as either tinners or fats, and no difficulty is experienced in getting good values for these.

PRODUCTION.

Farm production averages for 1950-51 are as follows:—

Local Authority.	Average Number of Cows in Production.	Average Yearly Milk Production.	
		Per Farm.	Per Cow.
		Galls.	Galls.
Clifton	18	7,200	400
Pittsworth	26	11,856	456
Cambooya–Toowoomba . ..	26	11,310	435
Queensland	..	..	284

The seasonal production varies rather widely, but in average seasons the Toowoomba, Cambooya, and Clifton areas often show up to 28% increase in the summer months, while Pittsworth district increases by approximately 17%.

SIZE OF FARMS.

The size of dairy farms also varies widely. A few in the environs of Toowoomba range from 60 acres to 100 acres, and some in the outlying areas of the shires are up to 700 acres. The greater number, however, would be in the 150-350 acres range. The following is a summary of information on herd size.

——	Cambooya–Toowoomba.	Pittsworth.	Clifton.
Number of Farms	399	349	321
Number of Dairy Cattle	16,114	13,482	9,482
Average Number of Cattle per Farm	40	40	40

BREEDS.

Australian Illawarra Shorthorn cattle predominate on the larger farms, especially in the milk-producing area, but Jerseys are also quite popular. Ayrshires and Guernseys are not so numerous as the two breeds mentioned, but Ayrshire and A.I.S. crosses are fairly popular.

HUSBANDRY METHODS.

As in every district, considerable variation in husbandry methods is noticeable, and here again, the high prices received for grain, and shortage of labour, have led to a decline in the popularity of dairying, with a consequent lowering of the standard of husbandry methods.

In many cases the easy way had, of necessity, to be taken, and ultimately has led to slipshod methods. However, there are still a large number of dairymen who regard dairying as their main source of livelihood and these men have maintained a high standard of efficiency.

As most dairymen depend on both summer and winter crops for grazing, and have the bull running free with the herd all the time, calvings take place throughout the year. Some dairymen control services and aim to have cows freshen at suitable periods when good feed can be expected. Approximately 65% of cows calve in the spring and summer months.

As most grazing is on crops, the herd nutrition is on a fairly high plane in normal seasons. There is, however, often a lag between crops, and then natural pasture and hay are very useful. A small percentage of dairymen also use grain supplements during such periods. This is quite economical in the case of fresh cows. Too few farmers consider the dairy herd as a unit through which the products of a mixed farming business should be marketed. Crops, both grain and hay, are frequently grown primarily for sale as cash crops and only incidentally as cow fodder. This method of land utilisation is unsound in principle. Much greater interest must be given to the animal side of the farm production in this area if soil fertility is to be maintained. A greater amount of fodder conservation is essential and a much greater proportion of farm produce should be marketed through the dairy cow.

HERD RECORDING.

Two Departmental schemes are in operation, one for purebred dairy cattle and one for grade herds.

Stud breeders realise that if they are to provide bulls for use in commercial herds which will transmit greater production qualities to their offspring, it is necessary to have factual knowledge of the production of the bulls' female ancestors as well as progeny tests of the male ancestors.

This can only be achieved by regular testing of all cows throughout their lactation periods.

More and more dairy farmers are becoming conscious of the need to use bulls from studs with high production averages and endeavour to purchase bulls from proven studs when they propose to rear heifers for herd replacements. Where all calves are sold as bobbies, beef bulls are often used with the object of securing more weight.

The grade herd testing scheme provides valuable records for the commercial dairyman. A growing interest in herd recording is being evidenced, and grading-up from the higher producing cows mated to purebred bulls from good herds is an increasing practice. The value of herd recording data in demonstrating faults in feeding methods and farm management has not yet been realised by most farmers, but it is probable that the wider acceptance of herd recording will have a most beneficial effect on husbandry methods adopted, quite apart from that achieved by the culling of low producers, which is the chief use to which data are put at the present time.



Plate 12.

Which Cow Can be Expected to Prove the More Profitable?

Herd recording units are established at Toowoomba and Pittsworth and owners desirous of having their herds tested for production can do so for a small fee. Many dairy farmers have availed themselves of this service with profit.

In the group herd recording division, the average production for cows of all ages in all Queensland for 1950-51 was 3,312 lb. of milk and 146 lb. of butterfat, the number of herds being 814. For the Eastern Downs, the average production for cows of all ages in 1950-51 was 3,939 lb. of milk and 167 lb. of butterfat, 169 herds having been tested.

Calf-raising methods are crude on most farms and malnutrition and deaths due to digestive disorders caused by haphazard feeding and internal parasites are common.

Where good facilities exist for calf rearing and care is taken to see that the calf is started on colostrum followed by wholemilk and gradually brought onto separated milk or calf meal, fed at reasonable intervals and right temperatures, little trouble is experienced. Any system of calf raising which fails to produce a heifer of approximately normal growth and weight at calving time should be considered inadvisable and poor economy.

STUD BREEDING ACTIVITIES.

The principal dairy breeds are well catered for by stud breeders, who compete keenly in their endeavour to raise the standard of production of the individual breeds to a high level. Many of the highest producing cows have been bred on the Downs and stud masters aim to supply sires which will maintain even if not improve production in commercial herds.

In the local authority areas under consideration, there are 42 registered A.I.S. breeders, representing 9% of the A.I.S. breeders of Queensland; eight registered Jersey breeders, representing 1% of the Jersey breeders; and six registered Ayrshire breeders, representing 13% of the Ayrshire breeders.

Some interest is again being shown by a few dairymen in breeds such as Guernsey and Friesian, but these represent a very minor proportion of the dairy breeds.



Plate 13.

Darling Downs Studs Contain Much Excellent Breeding Stock.

TRENDS.

Many farmers and graziers in this area commenced as dairymen, finding that that practice enabled them to take the fullest advantage of family labour, but they diverted their activities to other types of farming as these became more attractive or as the labour position for dairying became more acute. Consequently, many of the original dairy farms in the area now produce stock, grain and fodder crops only. Many farmers will not tie themselves to dairying when they can make a comfortable living by growing grain, but where sufficient labour is available, dairying is still profitably carried out.

Many dairy farms are worked on a share basis, the share farmer providing the labour and a portion of the working costs, the owner providing the property, stock and plant.

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

SIZE OF SAMPLE

Barley -	8 oz.	Oats -	8 oz.
Beans -	8 oz.	Peas -	8 oz.
Grasses	2 oz.	Sorghum	4 oz.
Lucerne	4 oz.	Sudan -	4 oz.
Millets	4 oz.	Wheat -	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.**

Bacteriological Testing of Market Milk in Queensland.

W. F. SCHUBERT and L. E. NICHOLS, Division of Dairying.

DURING the past 10 years, the pasteurisation of milk in Queensland has increased at a rapid rate, with the result that today the majority of the larger towns and centres have modern pasteurising plants. The growth of pasteurisation has stimulated the bacteriological tesing of both the raw and the processed products. In this article, raw and pasteurised milk tests, as conducted at Brisbane, are reviewed at length and the results for the past six years are discussed.

The market milk industry, though not the largest segment of the dairying industry in Queensland, is nevertheless very highly developed. Brisbane, the capital city, has no fewer than four large pasteurising plants catering for a population of approximately half a million. In addition, the major cities and centres in the eastern districts possess modern pasteurising plants. Proceeding from south to north, those near the coast are located at Merrimac, Southport, Nambour, Maryborough, Bundaberg, Rockhampton, Mackay, Innisfail, and Cairns. Pasteurisation centres further from the coast are Toowoomba, Ipswich, Warwick, Murgon and Malanda.

The operational pattern is more or less the same in each case. The milk is produced in the territory immediately surrounding the town in which it is consumed, the area of the "milkshed" depending upon the size of the town, the *per capita* consumption of milk within the particular town and the intensity of milk production in the adjacent farming area. In some instances, the maintenance of continuous milk supplies throughout the year constitutes a serious problem and the milksheds have to be periodically extended to counteract such influences as floods, droughts and the decline in milk production during the winter months. This lack of equilibrium in the milk supply position adds considerably to the problems of quality control.

ORGANISATION OF THE BRISBANE MILK SUPPLY.

The Brisbane Milk Board.

Milk and cream supplied for consumption or use within the Brisbane Milk District are under the control of the Brisbane Milk Board, which was reconstituted under *The Milk Supply Act of* 1952. The Board consists of a chairman appointed by the Governor-in-Council to be the representative of the Government and Executive Officer of the Board, and five other members, two of whom represent the producers, one the wholesale vendors, one the retail vendors, and one the consumers. The new Board operates from July 1, 1953.

The Brisbane Milk District.

The Brisbane Milk District occupies an area of 375 square miles and has a population of approximately half a million. The whole of the city's milk requirements is controlled by the Milk Board. Beyond the Brisbane Milk District the milk supply is controlled by the association or company purchasing the milk for pasteurisation.

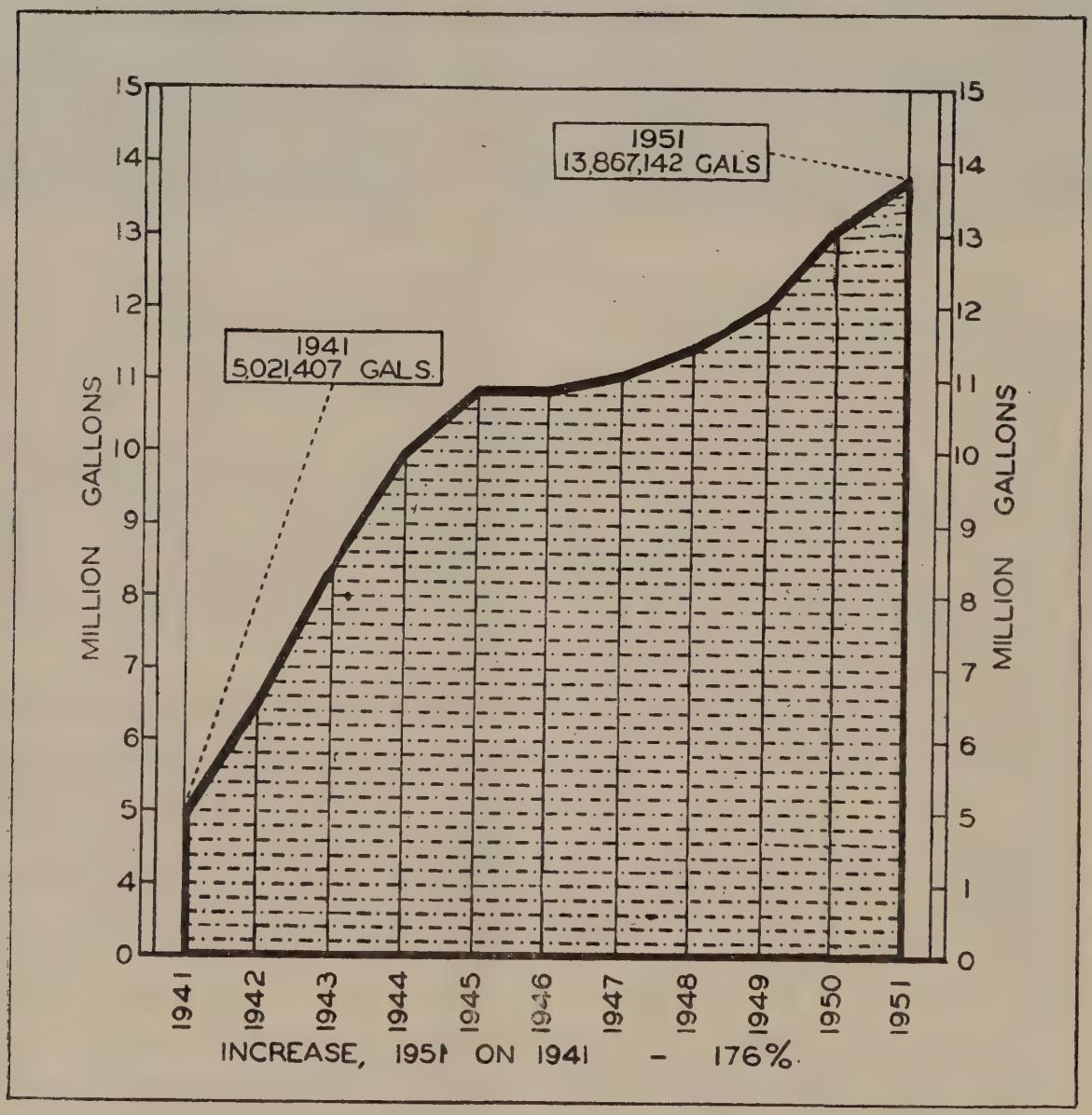


Plate 1.

Graph Showing the Growth in the Supply of Board-Controlled Milk to Brisbane.

Sources of Supply.

The supply pattern for Brisbane is more or less typical of the whole of the State. Plate 2 shows areas from which milk is supplied to Brisbane. Milk may flow to the processing plant through two channels:—

(1) Suppliers may forward milk direct to the city pasteurising plant.

(2) Milk may be collected at a country receiving depot, where after chilling it is loaded into cans or tankers for transport to the city pasteurising plant.

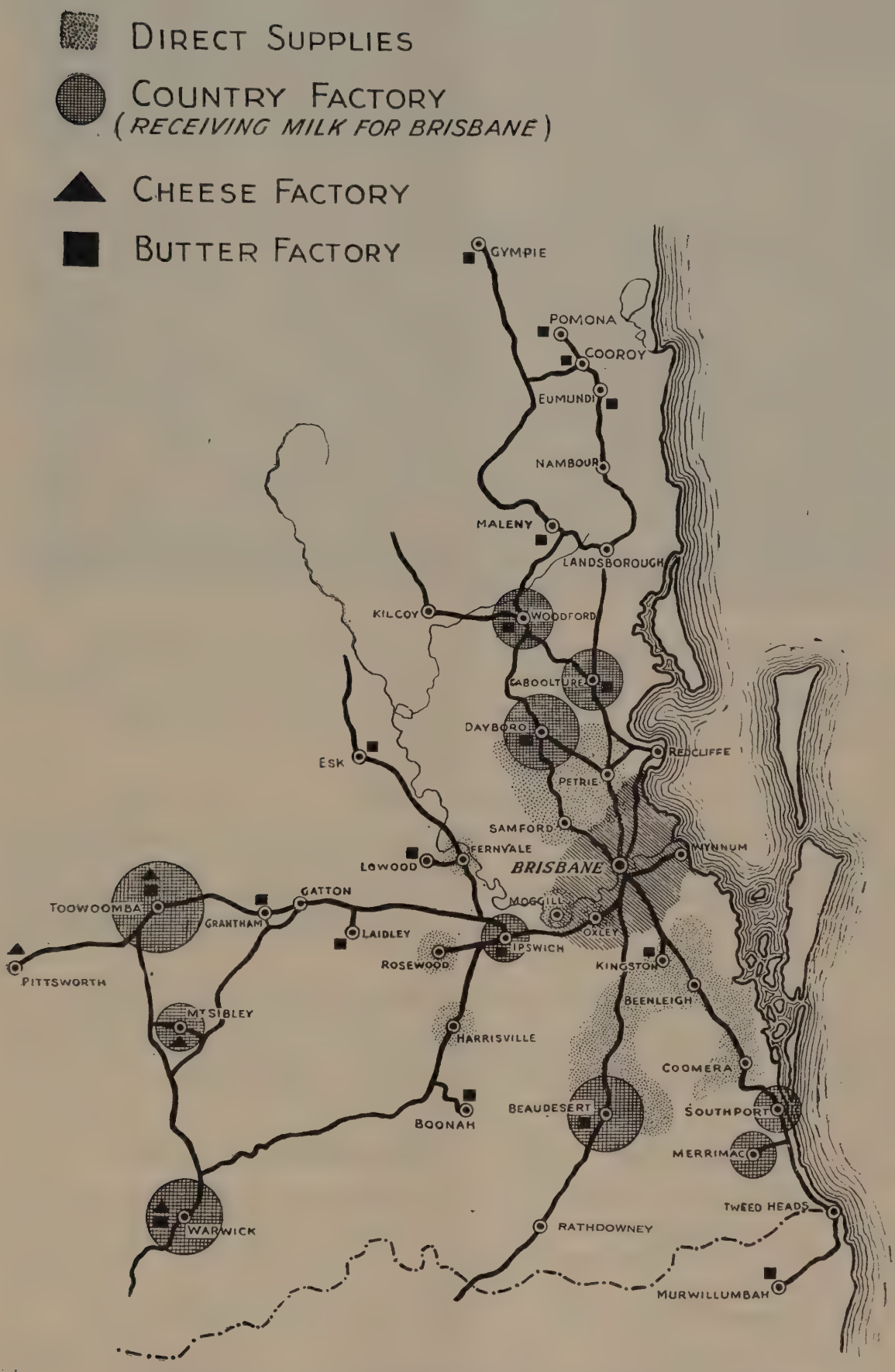


Plate 2.

Map Showing Areas of Supply for the Brisbane Milk Market.

Registration of Suppliers.

Producers supplying milk to pasteurising plants within the Brisbane Milk District are required to register with the Brisbane Milk Board. Such registration has to be renewed annually. A Field Officer of the Board or a Dairy Officer of the Department of Agriculture and Stock investigates each supplier seeking registration. Registration is approved provided the following minimum requirements are satisfied:—

(1) The dairy premises must be in a reasonable state of repair and drained in accordance with *The Dairy Produce Acts,* 1920 *to* 1952.

(2) The dairy must be provided with an adequate water supply.

(3) An adequate supply of boiling water for cleaning and sterilizing equipment must be provided in accordance with *The Dairy Produce Acts,* 1920 *to* 1952.

(4) A regulation wash-up trough and draining rack must be provided.

(5) The dairy utensils, premises and surroundings must be maintained in a clean and sanitary condition.

The fundamental requirements outlined above are considered to be minimum for every milk farm in the State. In centres outside the Brisbane Milk District, Dairy Officers of the Department of Agriculture and Stock constitute the approval authority.

Transport of Milk.

Farmers' milks are picked up by carriers and transported to pasteurising plants in the metropolitan area or to country chilling depots. The routes are gazetted and the cost of transport is borne by the producers. Bulk chilled milk from country receiving depots is mainly transported by tankers.

In a few cases, the milk is heat-treated before being loaded into tankers for transport to the metropolitan area. Such milk is described as processed. The Milk Sellers Regulations define pasteurised milk as milk heated to prescribed temperatures and then bottled.

FIELD STAFF AND LABORATORY SET-UP.

Within the Brisbane Milk District, Milk Board Field Officers and officers of the Department of Agriculture and Stock work in close collaboration. Both groups of officers provide the liaison between the laboratory work performed by the Dairy Research Laboratory, within the Department of Agriculture and Stock, and the field work.

A similar organisation exists at Toowoomba, on the Darling Downs, which supplies a considerable volume of milk to Brisbane.

In other centres of Queensland, quality control work is carried out exclusively by officers of the Department of Agriculture and Stock.

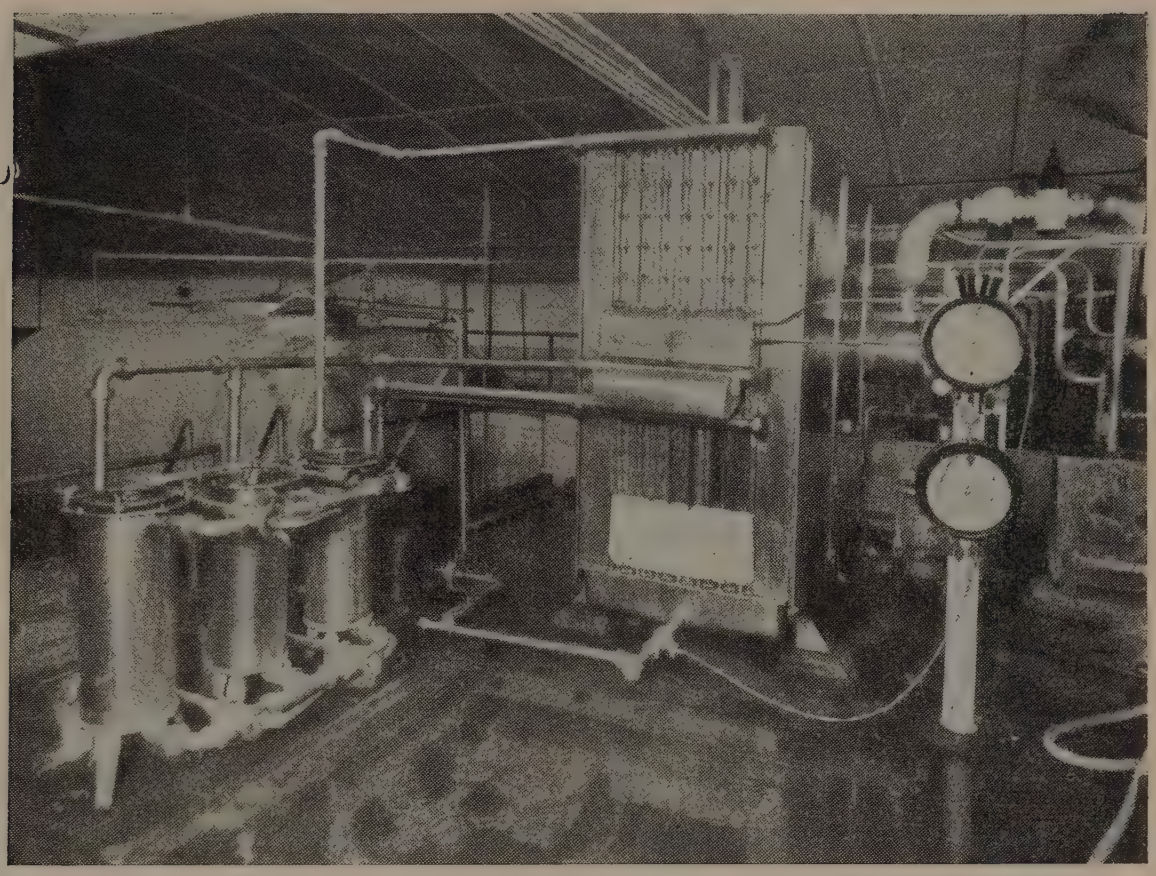


Plate 3.
A Pasteuriser in a Brisbane Milk Processing Factory.

SYSTEMS OF PASTEURISATION APPROVED IN QUEENSLAND.

In Queensland, the Health Department approves the systems of pasteurisation to be used in the market milk industry. Both the high temperature-short time and the holder systems are approved. The H.T.S.T. types of equipment predominate. The systems of pasteurisation approved are embodied in Clause 2 of Section 29 of the *Food and Drug Regulations,* 1939. The clause reads as follows:—

"2. Pasteurised milk is milk which:—

(1) has been treated by one of the following methods:—

(*a*) By heating all of the milk to a temperature of not less than 142 degrees and not more than 148 degrees Fahrenheit and holding it at such temperature for not less than thirty minutes and immediately afterwards reducing it to a temperature below 40 degrees Fahrenheit.

(*b*) By heating all of the milk to a temperature of not less than 162 degrees Fahrenheit, and retaining it at such temperature for at least fifteen seconds and immediately afterwards reducing it to a temperature below 40 degrees Fahrenheit; such milk having been treated by means of apparatus approved by the Director-General, thermostatically controlled and provided with indicating and recording thermometers and with a device which automatically diverts the flow of any milk which has not been retained at a temperature of not less than 162 degrees Fahrenheit for at least fifteen seconds."

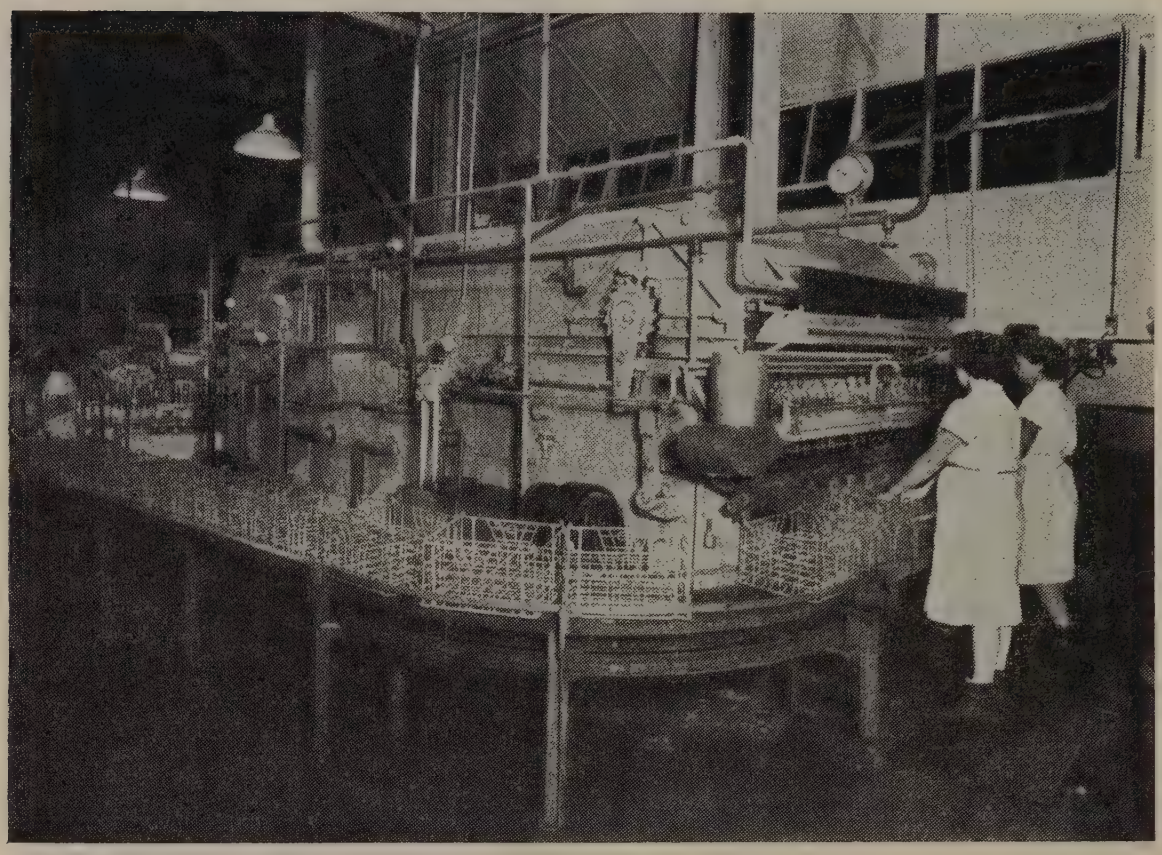


Plate 4.
A Bottle-Washing Machine Capable of Cleaning and Sterilizing 12,000 Bottles Per Hour.

QUALITY TESTS FOR RAW MILK.

Organoleptic Grading.

On arrival at the depot, the raw milk is graded by a factory operative. Experienced graders can detect with a high degree of accuracy characteristic odours in milk associated with—(*a*) mastitis, (*b*) improper cooling, (*c*) dirty utensils, and (*d*) feedy and weed taints. By this means milk of unsatisfactory quality can be rejected before it is mixed with the general supply.

Modified Methylene Blue Test.

The main test used for gauging the bacteriological quality of raw milk in Queensland is the Modified Methylene Blue Test. In the city plants and country chilling depots, each supplier's milk is subjected to this test twice a week. A few plants have elected to perform the test daily on all suppliers' milks.

Sampling.—The sampling is carried out by either of the following methods:—

(1) A weighing-vat sample is taken, using a small dipper (preferably a 10 ml. stainless steel dipper) to dip the sample from the vat.

(2) A can sample is taken (using a 10 ml. dipper) after the contents of the cans have been thoroughly mixed.

Legal Standards.—Queensland Food and Drug Regulations which relate to milk sold for human consumption prescribe that milk shall not decolourise methylene blue within three hours if the sample is taken at any time from 1st October to 31st March, or within four hours if the sample is taken at any time from 1st April to 30th September.

In connection with the milk quality advisory services operated by the Division of Dairying in Queensland, the following tentative standards are used as being ideals of achievement:—

Good Milk—Tests more than 5½ hours.

Fair Milk—Tests between 5½ and 4 hours.

Unsatisfactory Milk—Tests less than 4 hours.

These objectives are laid down with a view to stimulating interest in further quality improvement and to maintain the highest quality milk for human consumption.

Low Quality Milk.—Milks failing the three-hour summer standard or the four-hour winter standard are smeared in the factory on specially prepared alphabetically lettered slides. The slides are then forwarded with the results to the Dairy Research Laboratory. Country depots forward slides and results to the laboratory by mail.



Plate 5.

Vacuum Filling Machines Capable of Filling 6,000 Bottles Per Hour.

At the end of each week, each factory or depot forwards details of all methylene blue tests performed to the central laboratory for record purposes and for examination as to quality trends each month.

Microscopic Examination of Slides.—On receipt at the laboratory, the milk smears are stained and examined microscopically to determine the cause of low quality. The following scheme of interpretation is used, based on the types of bacteria and the number of body cells present.

Symbol.	*Interpretation.*
(A)	Unclean utensils.
(B)	Contamination from the environment (barns, dust, &c.).
(C)	Improper cooling; mixed p.m. and a.m. milk; milk residues.
(D)	Mastitis infection.
D (?)	Suspected mastitis; milk used too soon after calving; late lactation milk; injuries to udder.

Recording of Results.—The results are entered upon the supplier's personal card and a report (see Form 1) forwarded indicating the results and offering suggestions for improvements. In addition, the results are handed to a Milk Board officer or a Dairy Officer for follow-up work. Any supplier who consistently forwards milk of low quality may have his quota suspended.

THE BRISBANE MILK BOARD.

REPORT ON MILK SAMPLE.

FROM DAIRY RESEARCH LABORATORY, DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.

Sample No...... **Date Taken:**.....

1. Temperature on arrival..... **°F.**

2. Methylene Blue Test..... **Hours.**

Standards.

Good Milk	**Tests more than 5½ hours.**
Fair Milk	**Tests between 5½ hours and 4 hours.**
Unsatisfactory Milk	**Tests less than 4 hours.**

3. Butter Fat.....

Standard
not less than 3.3%.

4. Microscopical Examination—

Please Note: Your main trouble, as indicated by this examination, seems to be

- ☐ A. Utensils not properly cleansed and sterilised.
- ☐ B. Dirty cows—dirt on udder or flanks; or Dust from manure, soil or feed in yards or bails.
- ☐ C. Inclusion of aged or stale milk.
- ☐ D. Udder infection, e.g., mastitis (or mammitis).

REMARKS:

Please note advice on back.

.....
Bacteriologist.

Date:.....

Form 1.

Accessory Grading Tests.

Milks which are unacceptable because of contamination with dirt, manure, &c., or because they contain other impurities, automatically reject themselves. There is obviously no need to subject such milks to the modified methylene blue test. In the final analysis, it has to be admitted that no scientific test at present known can replace palate grading acquired by long experience.

Sediment tests are periodically performed by Field Officers on suppliers' milks. The presence of hair, dust, and body cells in milk can seriously interfere with the efficiency of pasteurisation.

The sediment test is very useful in educating farmers to use cotton-wool filter discs to strain milk at the milking shed, as the visual evidence of failure to do this is readily appreciated by producers.

Pasteurisability Test.

This consists of making a bacterial count of the supplier's milk after subjecting a small sample of the milk to conditions of time and temperature similar to pasteurisation in the factory. The main purpose of this test is to detect the presence of bacteria which are either resistant to heat or can live and multiply at high temperatures. These may be present in such numbers as to prevent the pasteurised product from conforming to the official standards laid down.

The problem of thermobacteria in raw milk is one which should receive more consideration. As far as is known, these bacteria have little effect on the keeping quality of raw milk, but the fact remains that such thermobacteria are usually associated with milkstone on equipment and cause plate counts of pasteurised milk to exceed the legal standard.



Plate 6.

The Control Laboratory in a Brisbane Milk Processing Factory.

QUALITY TESTS FOR PASTEURISED MILK.

As the quality of pasteurised milk is largely dependent on its bacterial content, the tests used in the laboratory are largely of a bacteriological nature. The following tests form the basis of laboratory control in Queensland:—

(1) The plate count, which gives an estimation of the bacterial content.

(2) Coliform test to detect bacteria which are presumptive evidence of contamination following pasteurisation.

(3) A phosphatase test to ascertain if all of the milk has been efficiently pasteurised.

(4) A methylene blue test for keeping quality and indication of bacterial content.

Official Regulations.

The Food and Drug Regulations lay down the following standards for pasteurised milk:—

(1) Plate count must be less than 50,000 per ml.

(2) No *Escherichia coli* must be found in 0·1 ml.

(3) Phosphatase test must be less than 2·3 Lovibond units.

The Dairy Produce Acts, 1920 *to* 1952, state that pasteurised milk should have a bacterial count of less than 50,000 organisms per ml.

Dairy Research Laboratory Standards.

Under the advisory service conducted by the Division of Dairying, the following tentative standards have been adopted:—

(1) Plate count—less than 50,000 colonies per ml.

(2) Presumptive coliform test—negative in 1 ml.

(3) Presumptive coliform incubation test—negative in 1 ml. after holding a 10 ml. sample for 5 hours at 98°F.

(4) Phosphatase test—less than 2·3 Lovibond units (that is, units of the blue colour developed during the test).

(5) Keeping quality test—pasteurised milk is considered to be of satisfactory keeping quality if it passes a half-hour methylene blue test after 24 hours' incubation at 68°F.

Sampling.

One, two or three bottles of pasteurised milk are picked up daily from the fillers of the pasteurising plants in the city area proper. Plants adjacent to the city area forward two bottles weekly to the laboratory by rail. Plants further afield forward two bottles weekly by air.

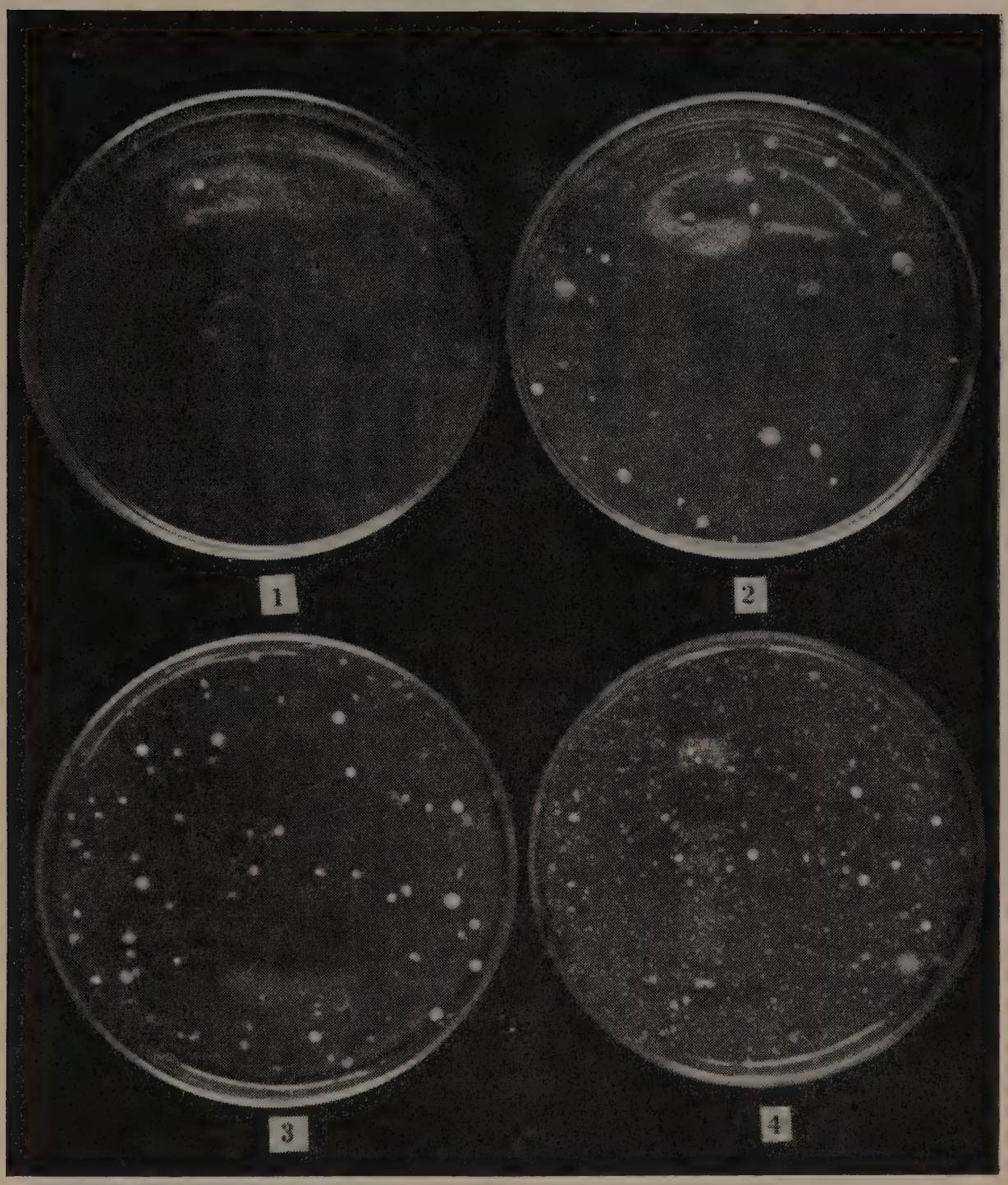


Plate 7.

Plates showing Various Degrees of Bacterial Content of Milk. Each colony has developed from a single bacterium.

Significance of the Tests Performed.

The Plate Count.—This test is performed by adding a small quantity of milk to a specified medium or bacterial food, which is then incubated in a petri dish or plate (Plate 7). Colonies develop from each bacterium present, and a visual determination of the number of bacteria in the milk is thus made simply by counting the colonies. By the shape, colour and specific reaction in different media, it is possible by this test to determine the types of bacteria present. In recent years the test has been subjected to a considerable amount of criticism and some countries have discarded it as a measure of the bacteriological quality of pasteurised milk. Though the many pitfalls inherent in the test are recognised in Queensland, it is still considered of value in determining the efficiency of the various stages of processing in factory surveys.

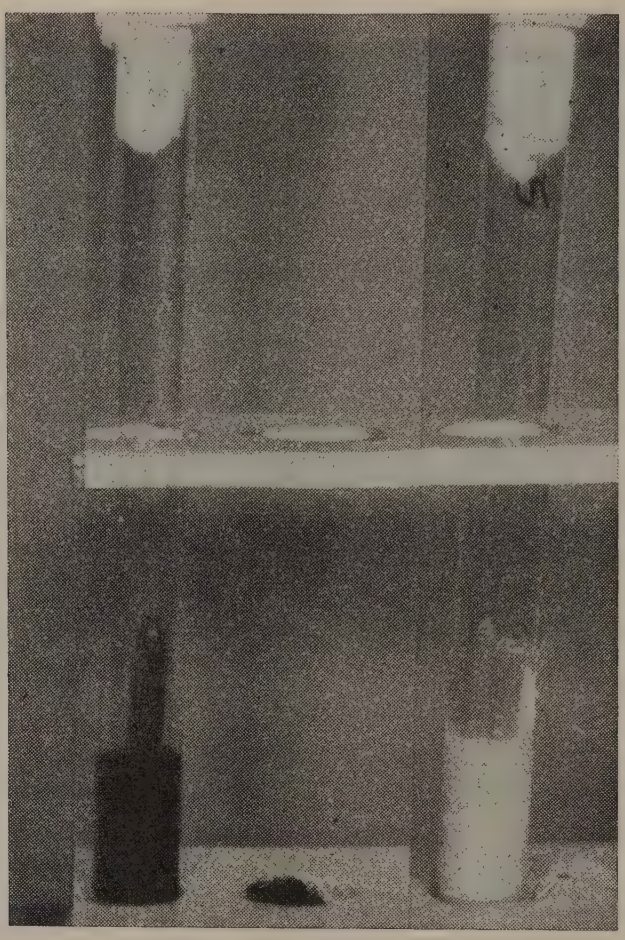


Plate 8.

Positive and Negative Presumptive Coliform Tests.

The Presumptive Coliform Test.—This test is based on the fact that the coliform group of bacteria readily ferment lactose in milk and thus endanger milk quality. Their presence is therefore undesirable. They are, however, readily destroyed at pasteurisation temperatures, but unless strict hygiene is observed, milk is readily re-infected. Their presence is therefore a guide to the degree of after-contamination occurring from milk processing equipment. Their absence is evidence of efficient cleansing and sterilizing procedures in factory operations. (Plate 8 shows positive and negative results). Laboratory experience has shown that well-run plants have no difficulty in attaining the standard of a negative presumptive test in 1 ml. of the pasteurised product.

The Presumptive Coliform Incubation Test.—This test serves as a means of detecting minor plant contamination of the pasteurised product. A 10 ml. sample of milk is incubated at 37°C. for a period of 5 hours, after which it is subjected to the presumptive coliform test.

Here again, well-run plants have little difficulty in satisfying the requirements of this test.

The Phosphatase Test.—This test is based on the fact that the phosphatase enzyme normally present in milk is destroyed at the critical temperatures applied in pasteurisation. Even a trace of raw milk added to properly pasteurised milk is detected by this method. Thus the test is most useful in ascertaining whether all of the milk has been satisfactorily heated.



Plate 9.

The "Straight-Through" Type Can Washer Which is Becoming Increasingly Popular in Queensland Milk Processing Factories.

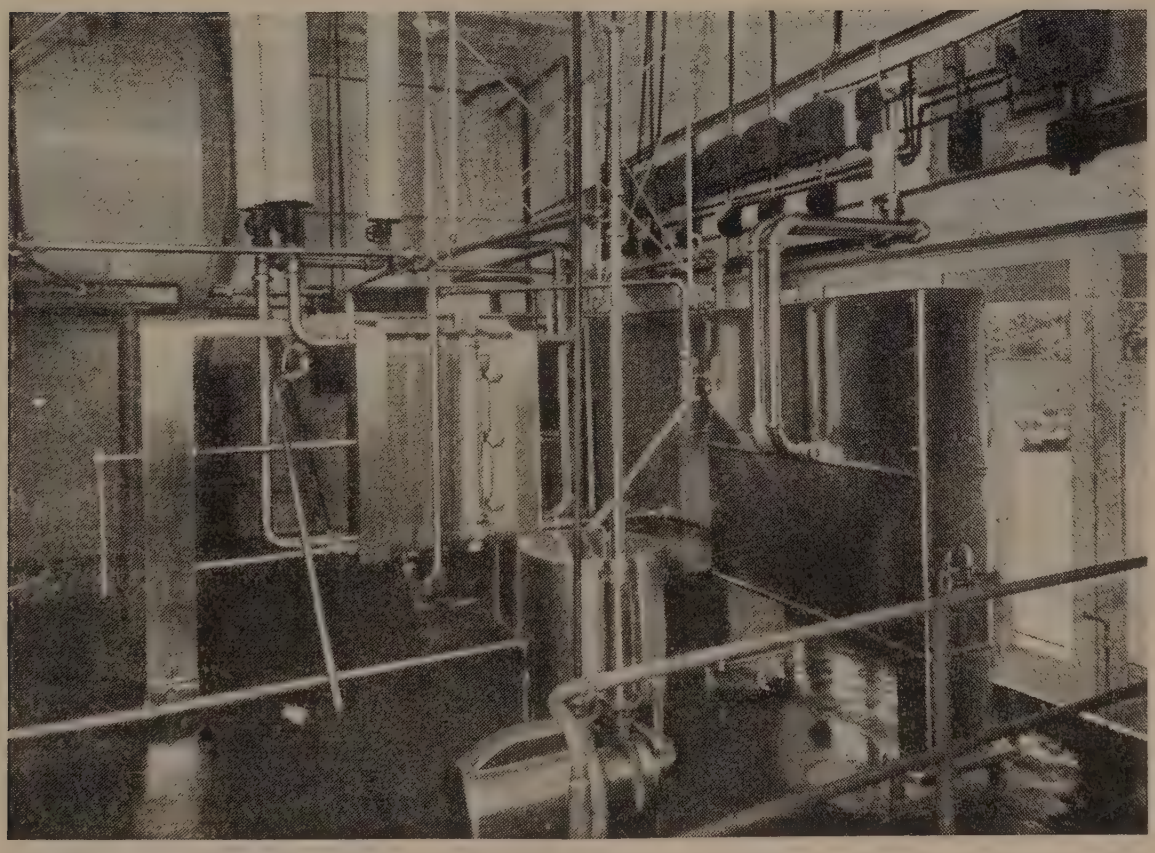


Plate 10.

A Milk Processing Unit in Operation in a Queensland Country Factory.

On the whole, very little trouble has been experienced with positive tests in Queensland practice. On the rare occasions when positives have been recorded, the fault has usually been traced to assemblage or operation of the plant by an inexperienced operative.

Keeping Quality Test.—This test is now gaining favour in overseas countries and is simply performed by storing a bottle of milk at 18°C. for 18-24 hours. Satisfactory keeping quality is indicated by the ability of the milk to last ½ hour on the methylene blue test. Work is proceeding with regard to the adoption of this test under field conditions in Queensland.

Examination of Washed Milk Bottles.

It is most important that bottles should be efficiently cleaned before filling with milk. To check the efficiency of bottle-washing, empty cleaned capped bottles are periodically picked up from the milk plants for examination for "commercial sterility" by means of a plate count on a rinse of the bottle.

A provisional laboratory standard of not more than 200 colonies per bottle has been adopted.

Regular examination of the strength of the solution in bottle-washing machines indicates that often alkalinity is not maintained in accordance with the recommendations of the makers.

Record of Results.

As soon as results are available they are forwarded to the processing plant with appropriate comments (see Form 2). In addition, a running record is kept of the results obtained by each plant.

THE BRISBANE MILK BOARD.

EXAMINATION OF PASTEURISED MILK.

By Dairy Research Laboratory, Brisbane.

Date Received.	Sample.	Bottled for (Day).	Plate Count.	Presumptive Coliform Test. 10 1 .1	Phosphatase Test.	Fat. %

STANDARDS:—1. Plate Count: Not greater than 50,000 per ml.

2. Presumptive Coliform Test: negative in 1 ml.

3. Presumptive Coliform Incubation Test (10 ml.): negative in 1 ml.

4. Phosphatase Test: negative (i.e., not greater than 2.3 Lovibond units).

5. Fat Content: not less than 3.3 per cent.

Senior Dairy Technologist.

Form 2.

MILK PLANT SURVEYS.

A bacteriological survey is made at each metropolitan milk plant at least once monthly. Observations are also made on the condition of equipment, mode of operation of the plant and general factory routine. Additionally, milk samples are taken whenever convenient and sent back to the laboratory for detailed bacteriological examination. The results are forwarded to the plants with appended recommendations. Plants outside the city area are surveyed at intervals, the actual bacteriological examinations being conducted on the spot by means of field equipment.

MONTHLY RECORD OF RESULTS.

On the completion of each month, a summary of all tests performed is prepared and forwarded to the Brisbane Milk Board. These monthly reports are incorporated in an annual report to the same body.

RESULTS COVERING SIX YEARS.

Table 1 is a summary of the work carried out by the Dairy Research Laboratory of the Department of Agriculture and Stock for the Brisbane Milk Board covering a period of five years. The year 1942-1943 is included for comparison purposes.

TABLE 1.

SUMMARY OF WORK AND RESULTS OF TESTS CARRIED OUT FOR THE BRISBANE MILK BOARD BY THE DAIRY RESEARCH LABORATORY, DEPARTMENT OF AGRICULTURE AND STOCK.

Data.	1942–43.	1946–47.	1947–48.	1948–49.	1949–50.	1950–51.
Platings—bottled pasteurised milk	927	1,021	957	952	1,310	1,234
Presumptive coliform tests..	918	818	855	978	1,037	1,205
Phosphatase tests—number	203	418	421	486	662	1,398
Percentage negative ..	80·3	..	98·0	97·0	99·7	99·1
Methylene blue tests at depots—number ..	..	72,217	79,579	82,242	79,057	78,122
Percentage below 4 hours ..	..	..	10·7	11·0	8·2	6·7
Methylene blue tests in laboratory	..	1,004	641	..	..	..
Microscopic examinations ..	..	4,328	4,975	4,183	5,124	4,293
Fat tests at depots—number	..	29,227	30,522	24,755	29,796	27,697
Percentage below 3·3% ..	..	..	1·2	14·0	12·0	11·1
Pasteurised milk fat tests ..	..	965	1,081	1,234	1,677	1,583
Average fat percentage (raw milk	..	3·69	3·74	3·70	3·71	..
Average fat percentage (pasteurised milk) ..	..	3·96	4·00	3·91	3·81	3·76
Methylene blue tests of bulk milk from country factories	..	1,595	2,593	3,120	3,204	2,781
Fat tests of bulk milk from country factories ..	..	1,568	2,600	3,086	3,054	2,666
Factory surveys	..	..	20	53	53	48
Suppliers suspended ..	..	54	15	6	6	3

These results reflect the increasing amount of work performed by the Dairy Research Laboratory of the Department of Agriculture and Stock in the field of milk quality control, and the response of milk plants to the control scheme indicates the increasing interest in the bacteriological grading of market milk.

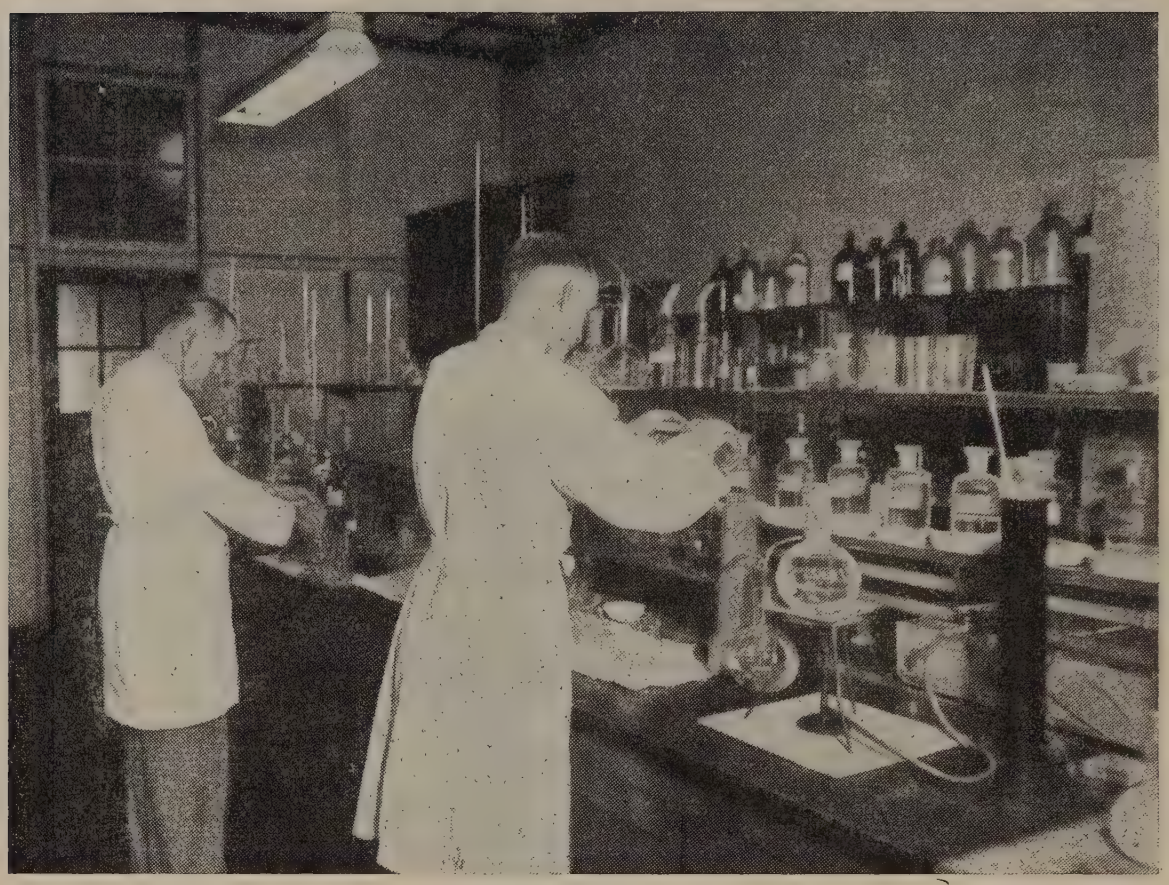


Plate 11.

Daily Milk Samples Being Tested in the Chemical Section of the Dairy Research Laboratory, Brisbane.

EXTENSION OF BACTERIOLOGICAL CONTROL OF MARKET MILK.

A laboratory at Toowoomba has for some years been offering a similar service to that already in existence in Brisbane. With the establishment of a dairy laboratory at Murgon in the South Burnett district and a projected laboratory at Malanda in North Queensland, the bacteriological control of market milk will soon be extended to the major dairying centres of the State.

FUTURE OF THE BACTERIOLOGICAL CONTROL OF MARKET MILK.

It is true that the bacteriological tests used in the control of market milk are among the most controversial aspects of dairy bacteriology. This has been largely conditioned by the fact that the term quality is rather a protean word and authorities find it difficult to adopt tests and standards which are all-embracing. The accumulation of knowledge through research often throws new light on firmly established tests, with the result that they are often modified. It is a hopeful sign that the market milk industry and the dairy bacteriologist have remained sufficiently plastic to be receptive to new ideas. However, irrespective of adjustments in certain tests, all have as their objective the overall improvement of milk quality.



Plate 12.

Daily Milk Samples Being Tested in the Bacteriological Section of the Dairy Research Laboratory, Brisbane.

REPORTS OF RESEARCH WORK.

The following papers record the results of research work in relation to the bacteriological testing of market milk in Queensland.

(1) Studies on the effects of transport and storage on the bacteriological quality of raw milk. Part 1. The reduction of methylene blue by raw milk as influenced by time and temperature of storage. By V. R. Smythe.

Certain aspects of Brisbane's milk supply are discussed and trends of air temperature and raw milk quality are illustrated graphically, using data obtained by testing 95,000 milk samples over a period of three years.

(2) Studies on the effects of transport and storage on the bacteriological quality of raw milk. Part 2. The effect of the milk can on the methylene blue reduction time. By V. R. Smythe.

Factors inherent in the milk can have been found to cause a marked fall in the reduction time of raw milk. The effect is accentuated by increased milk temperature and by prolonged transport. Furthermore, such factors result in a greater degree of injury to high-quality milks than to low-quality milks. No attempt has been made to differentiate between individual can factors.

(3) A laboratory whirler for determining counts of thermoduric organisms in raw milk supplies. By V. R. Smythe.

A laboratory whirler which permits the rapid performance of thermoduric counts on milk samples is described. The method is faster and more convenient than the orthodox roll-tube count and yet retains all the advantages of roll-tube counting.

(4) A method for detecting sources of milk contamination on farms. By V. R. Smythe and Dawn Tabrett.

A method has been devised for locating readily the sources of milk contamination on dairy farms. The method embodies rinsing with aseptically drawn milk all the surfaces likely to provide contamination, and performing bacteriological tests on the rinsings. It has been found practicable under Queensland field conditions, and furthermore lends itself to considerable modification to suit various conditions. Results of methylene blue reduction tests and plate counts for several farms are tabulated.

(5) The value of the resazurin test for the determination of milk quality. By W. F. Schubert and Patricia M. Nagle.

Both the 10-minute and the one-hour resazurin tests were compared with the "modified" methylene blue test, the standard plate count at 37°C., the direct microscopic count and the leucocyte count.

(6) A comparison of a quaternary ammonium compound and a calcium hypochlorite compound as a germicidal agent. By W. F. Schubert.

A calcium hypochlorite compound and a quaternary ammonium were tested by the Weber-Black Method with a laboratory strain of *Escherichia coli* as the test organism. The hypochlorite showed the greater efficiency, probably because of the lower resistance of the gram-negative organism.

(7) The bacteriological content of dairy farm utensils cleansed with approved detergents. By W. F. Schubert.

An investigation designed to obtain information on the bacteriological condition of dairy farm utensils cleansed with approved detergents was carried out during 1951 on selected farms. This work emphasised the value of the technique of cleansing and sterilizing rather than the relative merits of the individual detergents and sterilants.

TECHNICAL APPENDIX.

The Plate Count.

For a large number of years this laboratory used the Yeastral media of the British Ministry of Agriculture and Fisheries (Memo. 139/Foods Jan. 1937) with incubation of the plates at 37°F. In recent years a change was made to the tryptone-glucose-meat extract-skim-milk media of the Standard Methods for the Examination of Dairy Products of the American Public Health Association, with incubation at 30°C. It was felt that this procedure was more suited to giving a maximum count in 48 ± 3 hours. Under these conditions, the lower temperature favours the development of thermobacteria.

The milks are plated according to the technique of the Standard Methods for the Examination of Dairy Products.

The Presumptive Coliform Test.

This test is used as an indicator of post-pasteurisation contamination. The presence of any coliforms is most undesirable, for the simple reason that they are lactose-fermenters and thus endanger quality. In routine laboratory work 1 ml. of milk is inoculated into the MacConkey broth as prescribed by the British Ministry of Agriculture and Fisheries (Memo. 139/Foods Jan. 1937). One departure from the British technique is that only 3 ml. of broth is used in each Durham fermentation tube instead of the 5 ml. laid down in the standardised procedure. Incubation is for 48 ± 3 hours. A positive result is interpreted as indication of post-pasteurisation contamination. Confirmatory and completed tests are occasionally carried out.

The Phosphatase Test.

This test, though not primarily a bacteriological one, is closely linked with the bacteriological examination of pasteurised milk. The Kay-Graham test is used in routine work. The long test is the only one used in the routine examination of pasteurised milk. A negative test is interpreted as showing that all of the milk has been properly heat-treated.

Keeping Quality Test.

Experiments have been conducted with this test with a view to its wholesale recommendation in milk plant work. However, difficulty has been experienced in obtaining a satisfactory low-temperature incubator to provide a uniform temperature of 18 $\pm$ 0.5°C. The effect of the holding temperature favouring certain types of bacteria is still under investigation.

Technique of Examining Washed Milk Bottles.

The method outlined by the British Ministry of Agriculture and Fisheries (Technque B743/T.P.B.) is used with one or two departures for the examination of the bottles. The departures from the British method are as follows:—

(1) The bottle is capped at the milk plant with an aluminium cap and not a rubber stopper as recommended. This procedure, it is felt, approximates more closely to the conditions under which milk is filled into the bottle.

(2) The colony count on the bottle is carried out on tryptone-glucose-meat extract media of the Standard Methods for the Examination of Dairy Products.

Sterility Tests on Equipment used for Milk Work.

Sterility tests are conducted on each batch of equipment used in routine milk work by the method set down by the British Ministry of Agriculture and Fisheries (Technique No. B/697/T.P.B). The technique has been found to be particularly useful in disclosing latent weaknesses in what are universally accepted as efficient bacteriological methods of preparing sterile glassware, blanks, &c.

References.

AMERICAN PUBLIC HEALTH ASSOCIATION. 1948. Standard Methods for the Examination of Dairy Products. 9th ed.

GREAT BRITAIN, MINISTRY OF AGRICULTURE AND FISHERIES. 1937. 139/Foods.

———. Technique B697/T.P.B.

———. Technique B743/T.P.B.

Weed Photographs for Display.

The Department of Agriculture and Stock has prepared a series of large coloured photographs of the more common weeds encountered in Queensland.

These photographs are available on request, wherever practicable, for display at country shows.

Show societies wishing to borrow the series should write to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Cans and Can Washing.

P. McCALLUM, Division of Dairying.

A VERY common saying on the part of most dairymen is that "everything must come out of the can". The term is usually used when alluding to the payment for some improvements on the farm or in the factory. Very often little thought is given to "what must go into the can", and in particular to care and cleaning to protect the quality of milk or cream put in the can. The cleaning and sterilizing of milk and cream cans is in many cases not given the attention its importance demands.

Regulation 189 of the Dairy Produce Acts prescribes certain requirements in the manufacture of milk and cream cans to ensure that cans of a satisfactory standard are produced. Care of the can during its period of use will not only prolong its life, but safeguard the quality of dairy produce.

Many dairymen overlook the can as a potential source of contamination. Milk or cream is in contact with the can for a longer period than with any other part of their equipment, and much deterioration can take place during the storage period between production and delivery to the receiving platform at the factory.

Cans must be structurally sound and free from rust holes and cracks or holes between the wall of the can and the bands. The can lid should not be overlooked. An amazing amount of contamination can take place from cans with such defects. Assuming that the can is in good order and well tinned, there are two types of contamination that can take place—(1) visible dirt, and (2) invisible dirt or bacterial contamination.

Visible dirt may consist of dust particles from the yard or feed stalls, adhering milk residues, or milkstone. These must be removed by cleaning and scrubbing in a detergent (cleanser) solution before the can is ready for sterilization by steam or boiling water. An apparently clean can may contain thousands, and in some cases millions, of organisms. A small amount of milky water in the can could contain many more millions of bacteria which would cause serious defects in milk or cream. Recently, when grading milk by smell and taste it was noticed that a can of milk had a foul odour which resembled the smell of a pigsty, and it was thought that the milk had absorbed the flavour from the atmosphere. However, closer examination revealed that the can lid was cracked around the inside seam and a foul exudate had contaminated the milk. The six gallons of milk which were rejected caused the farmer a loss of £1.

The return of unclean and improperly washed cans from the factory to the supplier has been the cause of much ill feeling between the farmer and the factory management. While it is the responsibility of the factory to return the cans in a clean, dry and near-sterile condition to the farmers, the individual attention that the cans should get on the farm will never entirely be done away with. Can-washing machines, like all other machines, on many occasions are not functioning at their top efficiency, but the operative on the can washer is often blamed for poorly washed cans while the trouble is not due to him but to a faulty machine.

OPERATION OF CAN WASHERS.

To enable farmers to understand a little more about can-washing machines, a brief outline of their operation is given. Can washers are of two types—(1) rotary, and (2) straight-through or tunnel type.

Rotary Machines.

Rotary machines have been in general use in factories for many years, but are giving way to the straight-through washer in many places. One of the main advantages of the rotary washer is that it requires minimum floor space. As cans have to be loaded and unloaded by hand, the output per minute is limited to about four to six. When the cans are loaded into the rotary machine, they are subjected to a cold or warm water rinse to remove the milk or cream from the cans and lids. Below the cans is a tray to catch rinsings, which are carried away from the washer to the floor, thus preventing the rinsings entering the soda solution in the washer. By depressing an automatic foot-pedal the cans move clockwise into the second chamber, which is only an idling chamber to prevent the operator and the cleansed cans and lids from being splashed.

In the third chamber the cans are subjected to the main cleansing process. Very hot (boiling) soda solution is pumped through jets under pressure and strikes the cans and lids externally and internally. It is very important that these jets be kept free from obstructions, or poorly washed cans result. In the next section the cans receive a liberal and forceful boiling water rinse, followed by intensive steaming. The proportion of water and steam is regulated by a tappet rocker arm. An excessive proportion of water to steam leaves the cans wet. Finally, they are given a hot air blast for thorough drying of cans and lids. They are then carried forward to the section where they entered and are unloaded from the machine.

Straight-through Machines.

Straight-through can washers are capable of washing up to 12 cans per minute. The cans may go direct from the tipping vat into the washer on endless chains and some can washers are also fitted with a can inverter and automatic lidding device at the outlet end of the washer. There are many different designs, but most types subject the cans to the following treatments:—(1) a pre-rinse or steaming in the draining section at the entrance to the washer; (2) outside and inside jet rinse with cold or warm water at a pressure of not less than 8 lb. sq. in.; (3) a detergent jetting with 3-9 galls. of 0.5% caustic soda solution at a pump pressure of 20-25 lb. sq. in. and at a temperature of not less than 160°F.; (4) a rinse with 2-7 gallons of water at a temperature of 180°-200°F. and at a pressure of 20-25 lb. sq. in.; (5) a near-sterile rinse at almost 212°F., followed by a steam blast; and, finally (6) a hot air blast at not less than 230°F.

Bacteriological Standards.

Bacteriological standards have been laid down to check the cleansing and sterilizing of cans immediately they come out of the can washer. The U.S.A. standard differs slightly from the British, which is as follows:—

Colonies per can.	Classification.
Under 50,000	Satisfactory.
50,000 to 250,000	Fairly satisfactory.
Over 250,000	Unsatisfactory.

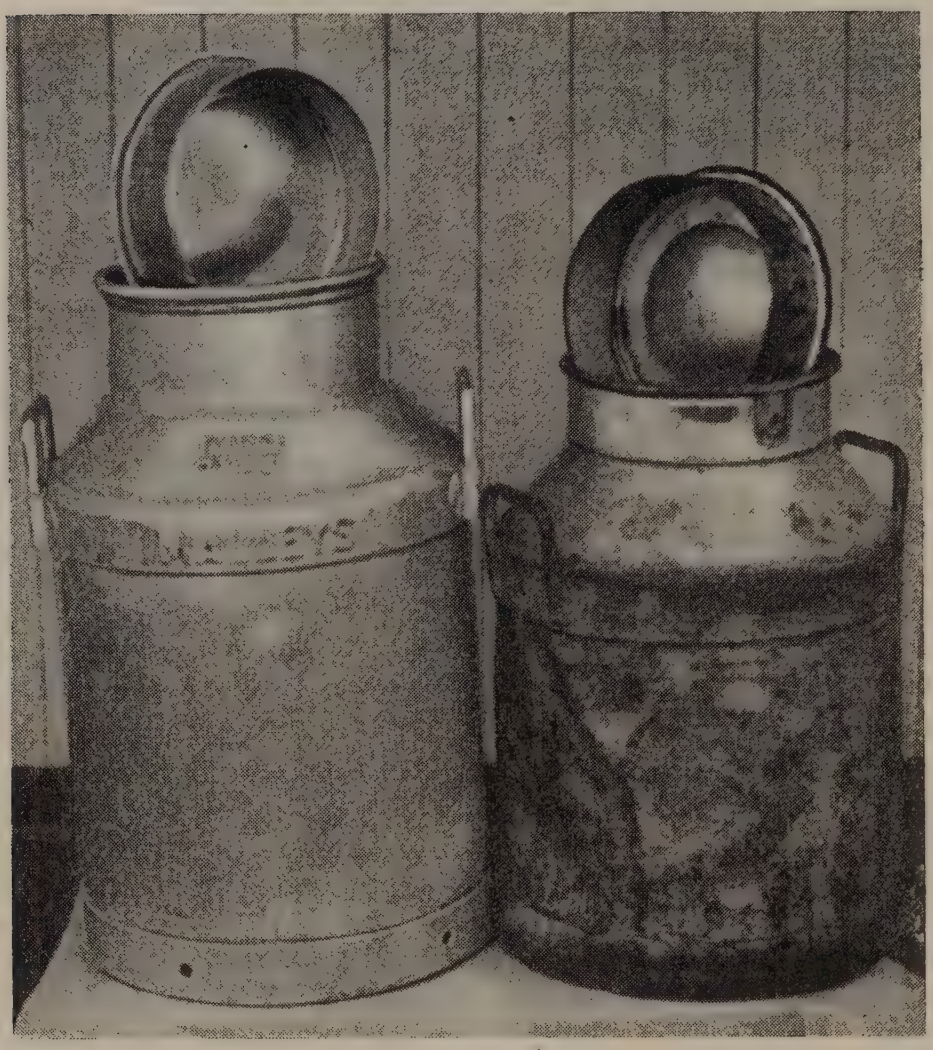


Plate 1.

Cans Used to Forward Milk to a Factory. Note the can with the dented walls, rust spots and cracked seam in the lid, all of which serve as harbours or breeding grounds for bacteria.

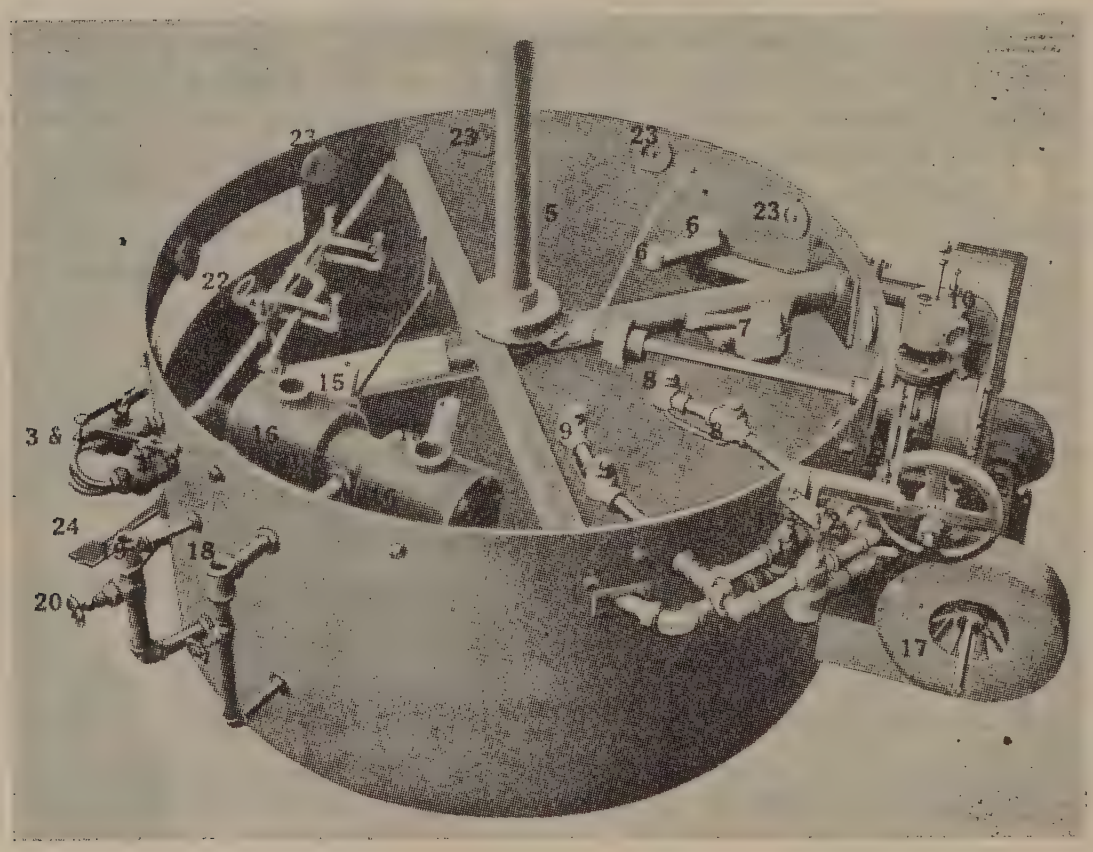


Plate 2.

A Rotary Can Washer, Illustrating the Main Parts.

—Photo. by James Bell Machinery Co.

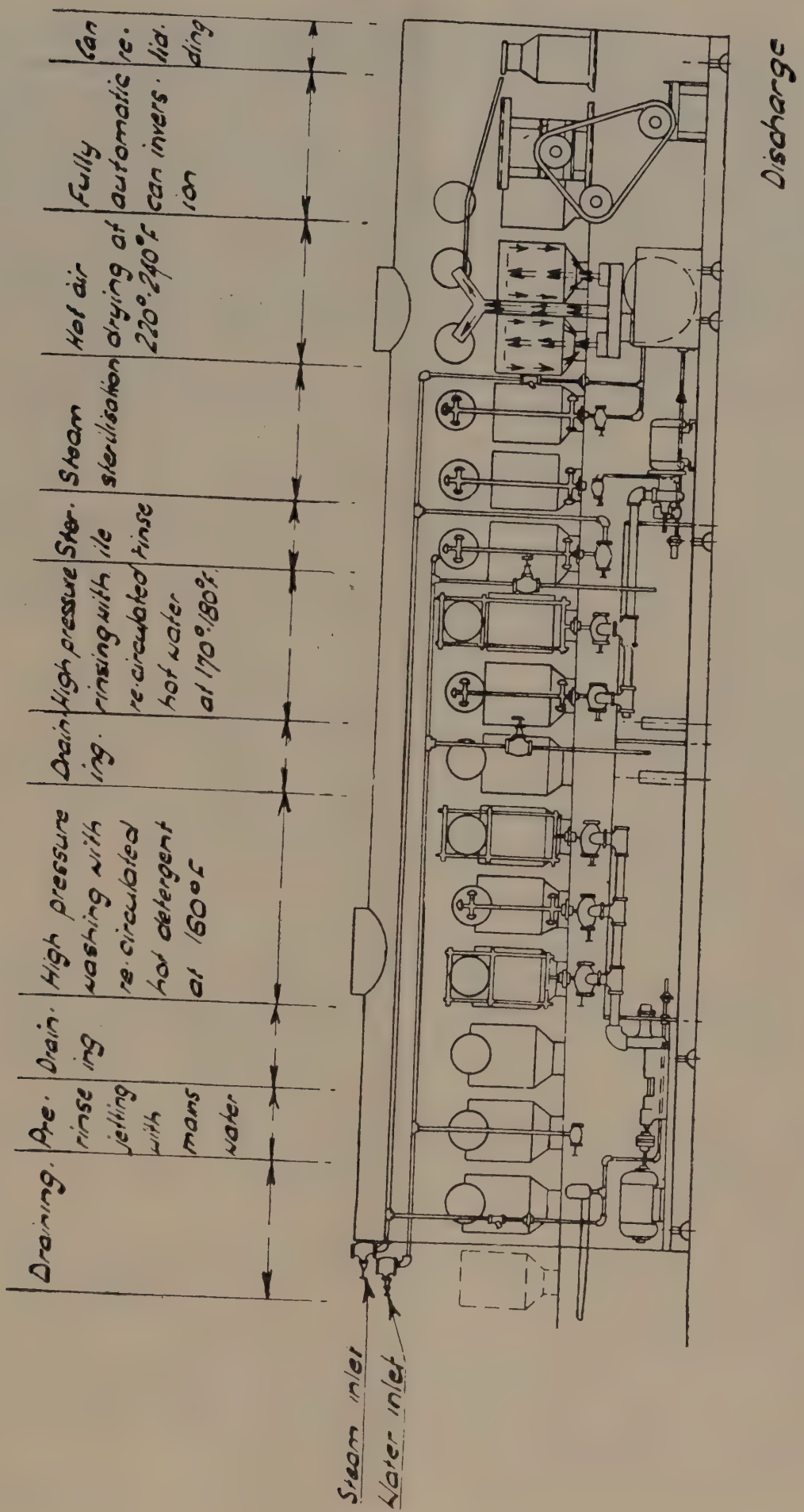


Plate 3.

A Straight-through Can Washer. Internal view of sections.

—Diagram from Bryant Bulletin.

CARE OF CANS.

To assist in improving milk and cream quality and prolonging the life of cans, the following points should be noted. New cans are covered with a film of grease, and this should be removed by thorough cleaning and scrubbing. Quite frequently milk or cream supplied in such cans without prior cleansing has an oily or metallic flavour and is degraded at the factory. In the cleaning of cans only a good detergent or cleanser, which must be thoroughly rinsed from the can with boiling water, should be used. If steam is available, steam for three minutes. Up-end to drain and dry on a metal draining rack. Immediately before use, rinse cans and lids with a chlorine solution prepared according to the instructions on the container. Do not use abrasive cleaners, as they cut the tinned surface of the can. It is very nice to see a clean, bright can, but a few dairymen are over-keen and cut away the tinned surface and retinning is then necessary. It is surprising how few dairymen clean the outside of the can and polish the label or name plate. Most cream graders are impressed by the condition and cleanliness of the can when grading cream. If they get a "border line" cream in a clean, bright can, they are inclined to bear a little with the farmer, but if the outside of the can is dirty and the name plate tarnished and almost indistinguishable, they do not take any risk with the cream and grade it down.

Using milk and cream cans for storing water on the farm is a bad practice, as it causes them to rust quickly. Many goods cans were spoilt during the 1951 drought where water had to be carted for dairy purposes. Milk or cream stored in a rusty can will quickly develop a "metallic" flavour and this type of flavour defect should cause the cream to be degraded to second grade. Metallic flavour is most objectionable, as it is intensified when the cream is subjected to the process of pasteurisation.

Plate 1 shows clearly the difference between a well cleaned and well cared for can, and an unwashed, neglected can as seen on a receiving platform. If you were a cream or milk grader, which can would most impress you? There would be no question concerning the standard of hygiene practised on the respective dairies from which these cans came.

It is essential that cream be stirred frequently during the day, but care is necessary if damage to the bottom of the can is to be avoided. Cream stirrers in poor condition are capable of doing harm to the tinned inner surface of the can.

Farmers frequently put wrong-fitting lids on cans before their despatch to the factory and much force is then necessary to remove them. This results in damage to the lid and neck of the can.

With regard to having cans retinned, it is recommended only with cans where rusting has not eaten into the base metal; any can which is soldered inside, in which rust has penetrated through to the base metal, or contains a hole, is unfit for retinning.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 27th MAY, 1953.)

Breed.	Owner's Name and Address.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
	L. Puschmann, Taylor
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

TESTED HERDS—continued.

Breed.	Owner's Name and Address.
Large White	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
	N. E. Meyers, Halpine Plantation, Kallangur
	Dr. B. J. Butcher & A. J. Parnwell, 684 Logan road, Greenslopes.
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Sherman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, Riverview
	F. Thomas, M.S. 373, Beaudesert
	A. J. Surman, Noble road, Goodna
	P. V. McKewin, " Wattleglen " Stud, Goombungee
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H.M. State Farm, Numinbah
	D. B- Alexander, Kinleymore, *via* Murgon
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirrett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, Trouts road, Aspley
	G. J. Wilson, " Glenbella " Stud, Silverleigh
	J. B. Dunlop, Acacia road, Kuraby
	A. Curd, Box 35, Jandowae
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.



The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

[*Continued from page* 302 *of the May issue.*]

Grey Ironbark.

Botanical Name.—*Eucalyptus drepanophylla* F. Muell. ex Benth., sometimes known as *Eucalyptus decepta* Blakely; it has also been mistaken for *Eucalyptus paniculata* Sm., which is not known from Queensland.

Other Common Names.—Thattinebark, white ironbark.



Plate 12.

Grey Ironbark (Eucalyptus drepanophylla). Leaves, buds and seed-capsules.

Distinguishing Features.—An ironbark (Plates 12 and 13) with relatively narrow leaves not always easy to distinguish from narrow-leaved ironbark (*Eucalyptus crebra*), to be described in a later section, but the leaves are rather broader, the timber not nearly so red, and the bark often not so black.

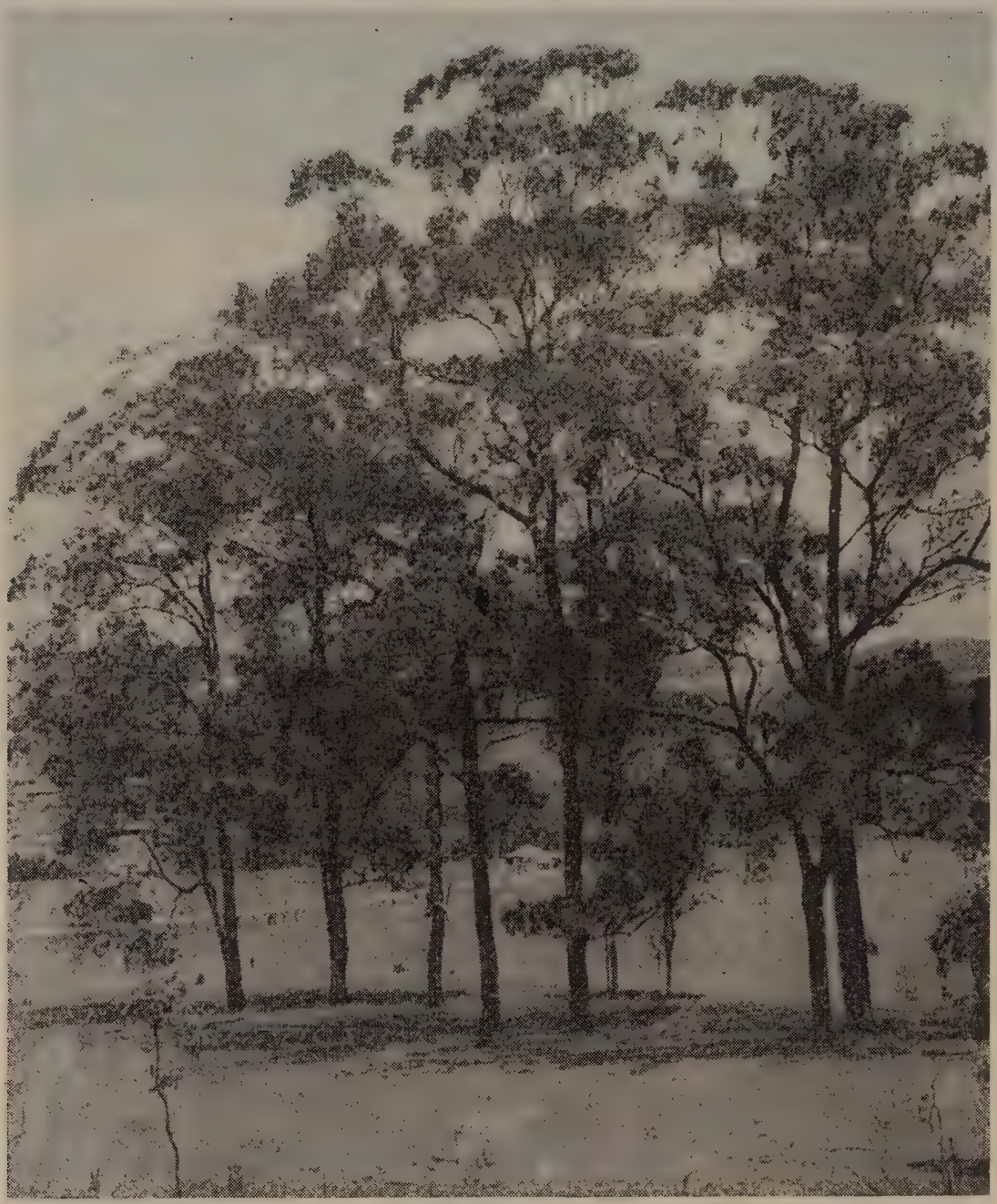


Plate 13.

Grey Ironbark (Eucalyptus drepanophylla). Clump at Brookfield.

Description.—A tree up to 80 ft. high or more, with dark grey, rough, deeply furrowed bark up to the small twigs. The leaves are mostly 5½-8 times as long as wide and about 3½-6 in. long, on stalks about ½ in. long. The flowers are borne in bunches at the ends of the twigs and are about ½ in. wide when fully open; the buds have a conical or nearly conical lid about as long as the lower part. The seed-capsules are cup-shaped or somewhat rounded, about ¼ in. long and nearly as wide; the valves are sometimes prominent.

Distribution.—Widely spread in the forest country in south-eastern Queensland; it is found nearly throughout eastern Queensland and northern coastal New South Wales.

Usual Flowering Time.—July to December.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Minor.

General Remarks.—Grey ironbark is one of the best known and most valuable of the coastal nectar-producing trees. Although some flowering occurs each year, about every third year large numbers flower together and good yields are harvested, particularly if suitable weather conditions prevail.

The honey is dense, has excellent colour and flavour, and granulates with a medium grain. As grey ironbark usually flowers with coastal gums, a pure sample of the honey is not readily obtained, although its flavour is normally predominant. The "ironbark-gum" blend is possibly the most popular of coastal honeys. The species is an unsatisfactory pollen plant, bees usually obtaining their requirements from other plants flowering at the same time.

Silver-leaf Ironbark.

Botanical Name.—Eucalyptus melanophloia F. Muell.

Other Common Names.—Silver leaf; broad-leaved ironbark.

Distinguishing Features.—An "ironbark" (Plates 14 and 15) with oblong or broadly rounded silvery or pale grey leaves with hardly any stalk and arranged in pairs along the twigs.



Plate 14.

Silver-leaf Ironbark (Eucalyptus melanophloia). Leaves, buds and seed-capsules.

Description.—A tree up to 40 ft. high, with blackish, hard, deeply furrowed bark up to the small twigs. The leaves are in pairs, silvery or pale grey, heart-shaped at the base with hardly any stalk, usually less than twice as long as wide, mostly $1\frac{1}{2}$-$2\frac{1}{2}$ in. long. The flowers are borne in small bunches at the ends of the twigs; the lid of the bud is conical, about as long as the lower part; the open flower is nearly $\frac{1}{2}$ in. wide. The seed-capsule is cup-shaped or somewhat rounded, about $\frac{1}{5}$ in. long and wide, with the tips of the valves somewhat projecting.

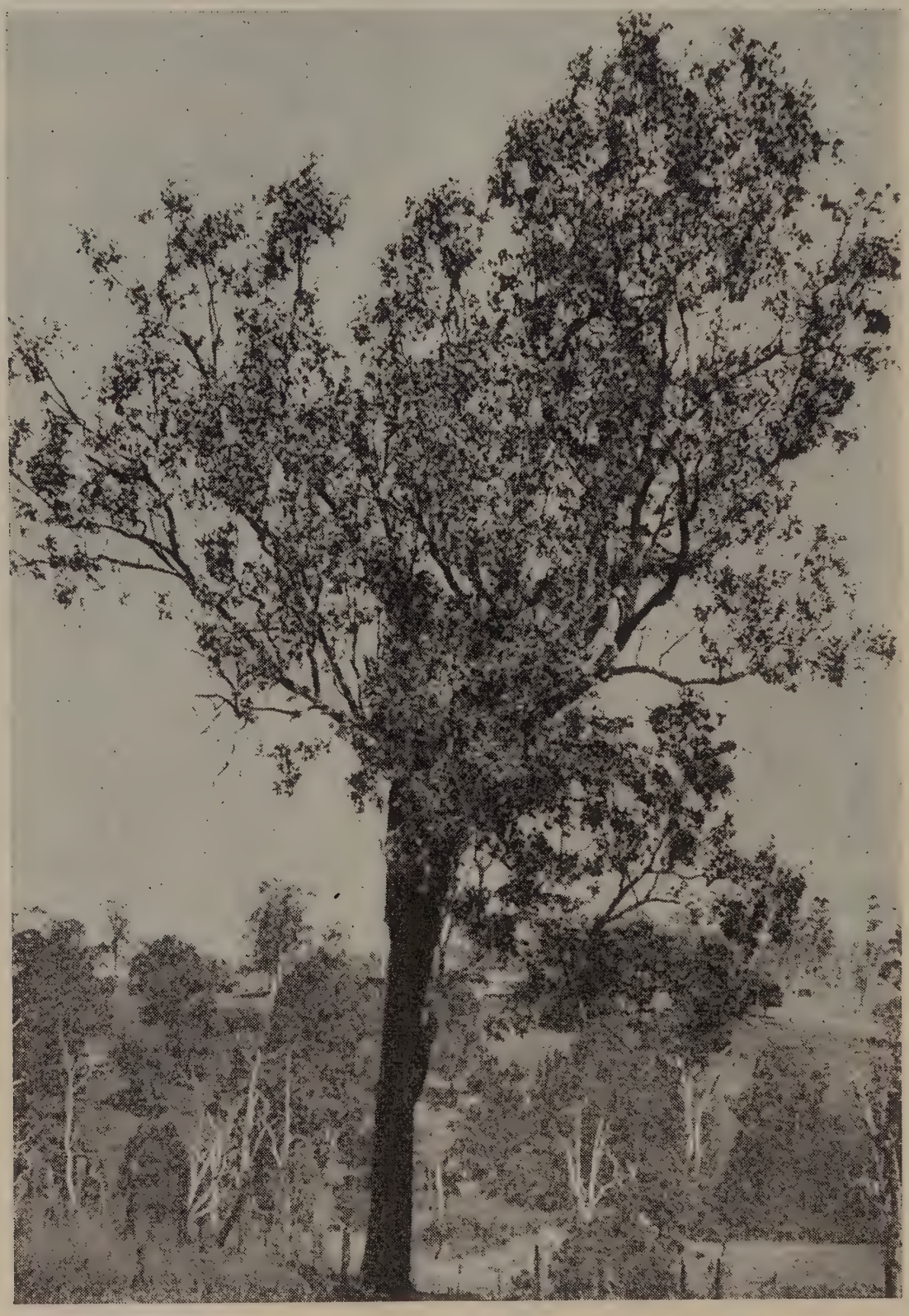


Plate 15.

Silver-leaf Ironbark (Eucalyptus melanophloia). Brookfield.

Distribution.—Nearly throughout the open forest country of south-eastern Queensland, often in pure stands. It is widely spread in Queensland and New South Wales.

Usual Flowering Time.—December to February.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium to major.

General Remarks.—This tree has a conflicting reputation as a nectar producer. In coastal ranges, many years may elapse without nectar being obtained in surplus amounts. Inland, useful quantities are harvested every second year. The flow is affected quickly and seriously by small variations in climatic conditions. The honey is dense and has a slightly aromatic flavour; it granulates slowly with a coarse grain and such honey has a "glassy" appearance.

Mugga.

Botanical Name.—Eucalyptus sideroxylon A. Cunn. ex Maiden.

Other Common Name.—Red ironbark.

Distinguishing Features.—An "ironbark" (Plates 16 and 17) with the small branches smooth and grey, and flowers produced in small clusters among the leaves.

Description.—A tree up to 100 ft. high, with hard, rough, deeply furrowed, grey or blackish bark on the trunk and main branches, and grey, smooth bark on the smaller branches; the furrows on the trunk



Plate 16.

Mugga (Eucalyptus sideroxylon). Leaves, buds and seed-capsules.

are often brownish on small trees. The leaves are greyish in colour, usually 3-8 times as long as wide, usually 3-5 in. long, on stalks about $\frac{1}{2}$ in. long. The flowers vary in colour from red through pink to white on different trees and are borne in clusters among the leaves; the buds have a conical lid shorter and narrower than the lower part; the open flower is about $\frac{1}{2}$ in. wide. The seed-capsules are oval or rounded, about $\frac{3}{8}$-$\frac{3}{4}$ in. long, and are carried on rather long stalks; the cells and valves are so deeply placed as to be not easily seen.

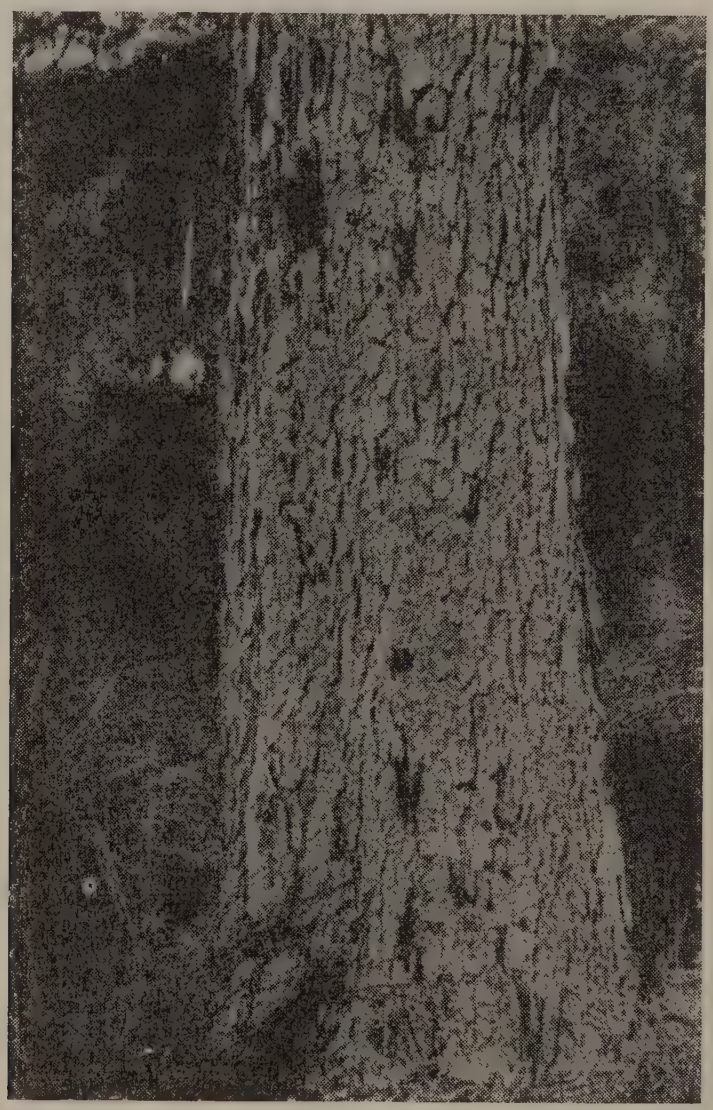


Plate 17.

Mugga (Eucalyptus sideroxylon). Botanic Gardens, Brisbane.

Distribution.—Open forest hillsides with sandy soil in the Darling Downs District and the southern part of the Burnett District; it is very rare in the Moreton District, chiefly on the slopes of the Great Dividing Range. It is widely spread in eastern New South Wales and in Victoria.

Usual Flowering Time.—July to November.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Nil to minor.

General Remarks.—The honey is of high quality, good body and granulates quickly with a fine grain. During early summer considerable quantities are obtained in apiaries situated near stands of mugga. Occasionally flowering is heavy in midwinter and when this happens only a limited amount of honey is gathered. With this early flowering some dwindling in colony strength may occur and this is due largely to the normally slow winter rate of brood replacement being restricted further by the shortage of pollen.

Pink Bloodwood.

Botanical Name.—Eucalyptus intermedia R. T. Baker.

Other Common Names.—Bloodwood, red bloodwood.

Distinguishing Features.—This tree (Plates 18-20) has a grey, flaky, brittle bark up to the small twigs, leaves much paler on the lower surface than the upper surface, large bunches of flowers at the ends of the twigs, and rather large and thick seed-capsules.

Description.—A tree up to 80 feet high with grey, flaky, brittle bark throughout, brownish when broken. The leaves are about 3-6 times as long as wide, about 3-6 in. long and $\frac{3}{4}$-2 in. wide, mostly pointed, rather dark and shining green on the upper surface, much



Plate 18.

Pink Bloodwood (Eucalyptus intermedia). Leaves, buds, flowers and seed-capsules.

paler and duller on the lower surface, with a large number of fine, parallel side-veins running from the midrib to the edges. The flowers are produced in large bunches at the ends of the twigs and are larger than those of most Queensland eucalypts, being about ¾ in. wide when fully out. The pointed lid is much shorter than the rest of the bud. The capsules are somewhat woody, about ½-¾ in. long, and their shape is somewhat like an egg with the top cut off.



Plate 19.

Pink Bloodwood (Eucalyptus intermedia). Portion of trunk.

Distribution.—Widely spread in forest country in the Moreton, Wide Bay, and Burnett Districts, never in pure stands and often as scattered trees. It is fairly common throughout the coastal belt of Queensland and northern New South Wales.

Usual Flowering Time.—January to March.

Colour of Honey.—Medium amber, occasionally with a reddish tint.

Importance as Source of Honey.—Minor to medium.

Importance as Source of Pollen.—Medium.

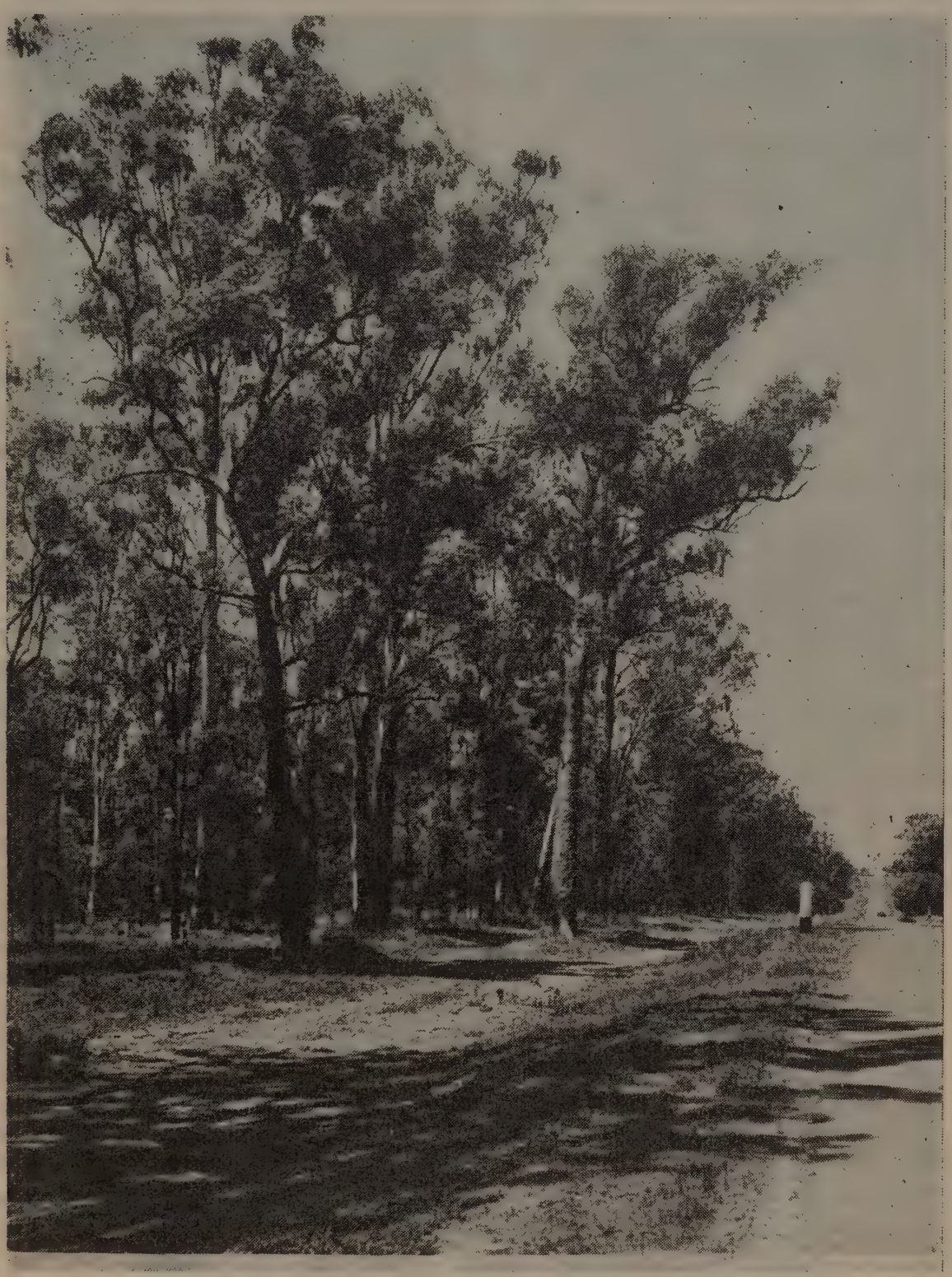


Plate 20.

Pink Bloodwood (Eucalyptus intermedia) at Rosewood.

General Remarks.—This tree, the most important of the bloodwood group, comes into flower during a period of nectar and pollen shortage, and colonies working the flow usually obtain some winter stores from this source. At the time of flowering, breeding may be stimulated to such an extent that heavy late swarming occurs.

The honey is of poor density and only fair flavour; it granulates with a large, soft-textured grain. Bloodwood honeys should not be removed from the hive until the bees have capped the entire comb surface, otherwise the extracted honey may ferment. Moderate flows are

obtained from this species at irregular intervals, and the crop harvested on such occasions is either utilised as the sweetening and colouring agent in some processed foodstuffs or blended with higher grade honey.

Like all bloodwood honeys, it is characterised by its stringiness—that is, the capacity to be drawn out into long fibres. This unique elastic property of bloodwood honeys is due to the presence of an unusual amount of dextran.

Note: On sandy soils in the Darling Downs District and in parts of the Burnett District, another bloodwood, sometimes called "long-fruited bloodwood" (*Eucalyptus polycarpa* F. Muell.), is found. This bloodwood differs from the ordinary pink bloodwood in having longer, narrower leaves, giving a somewhat weeping appearance to the crown, and nearly oblong capsules; the buds also are whitish instead of reddish. Another bloodwood (*Eucalyptus gummifera* (Gaertn.) Hochr., also known as *Eucalyptus corymbosa* Sm.), likewise popularly called red bloodwood or pink bloodwood, is found on deep sandy soil near the coast in south-eastern Queensland and occasionally further inland, but it is much commoner in New South Wales, south of Newcastle. There has been a lot of confusion between *Eucalyptus intermedia* and *Eucalyptus gummifera,* but the latter may be distinguished by the smaller branches being smooth and greyish white, the bark on the trunk being reddish, not brownish when broken, the denser foliage, the very small lid of the bud, and the top edge of the seed-capsule spreading outward.

White Bloodwood.

Botanical Name.—Eucalyptus trachyphloia F. Muell.

Other Common Names.—Yellow bloodwood, brown bloodwood.

Distinguishing Features.—This tree (Plates 21-23) has a flaky, brittle bark on trunk and main branches, and smooth, greyish or whitish bark on the small branches; rather small leaves, much paler on the lower surface than the upper; and large bunches of flowers at the ends of the twigs.

Description.—A tree up to 70 feet high with grey, flaky, brittle bark on the trunk and main branches, but smooth and greyish or whitish on the smaller branches, where it is shed in long strips. The leaves are about 5-8 times as long as wide, about 3-4½ in. long and ½-¾ in. wide, green on the upper surface, very much paler on the lower surface, with a large number of fine parallel veins running out from the midrib to the edges. The flowers are produced in large bunches at the ends of the branches and are about ⅜ in. wide; the lid is very short. The seed-capsules are shaped somewhat like an egg with the top cut off or like a small cup, between ¼ in. and ½ in. long and about ¼ in. wide.



Plaet 21.

White Bloodwood (Eucalypus trachyphloia). Leaves, flowers, buds and seed-capsules.



Plate 22.

White Bloodwood (Eucalyptus trachyphloia). Portion of trunk.

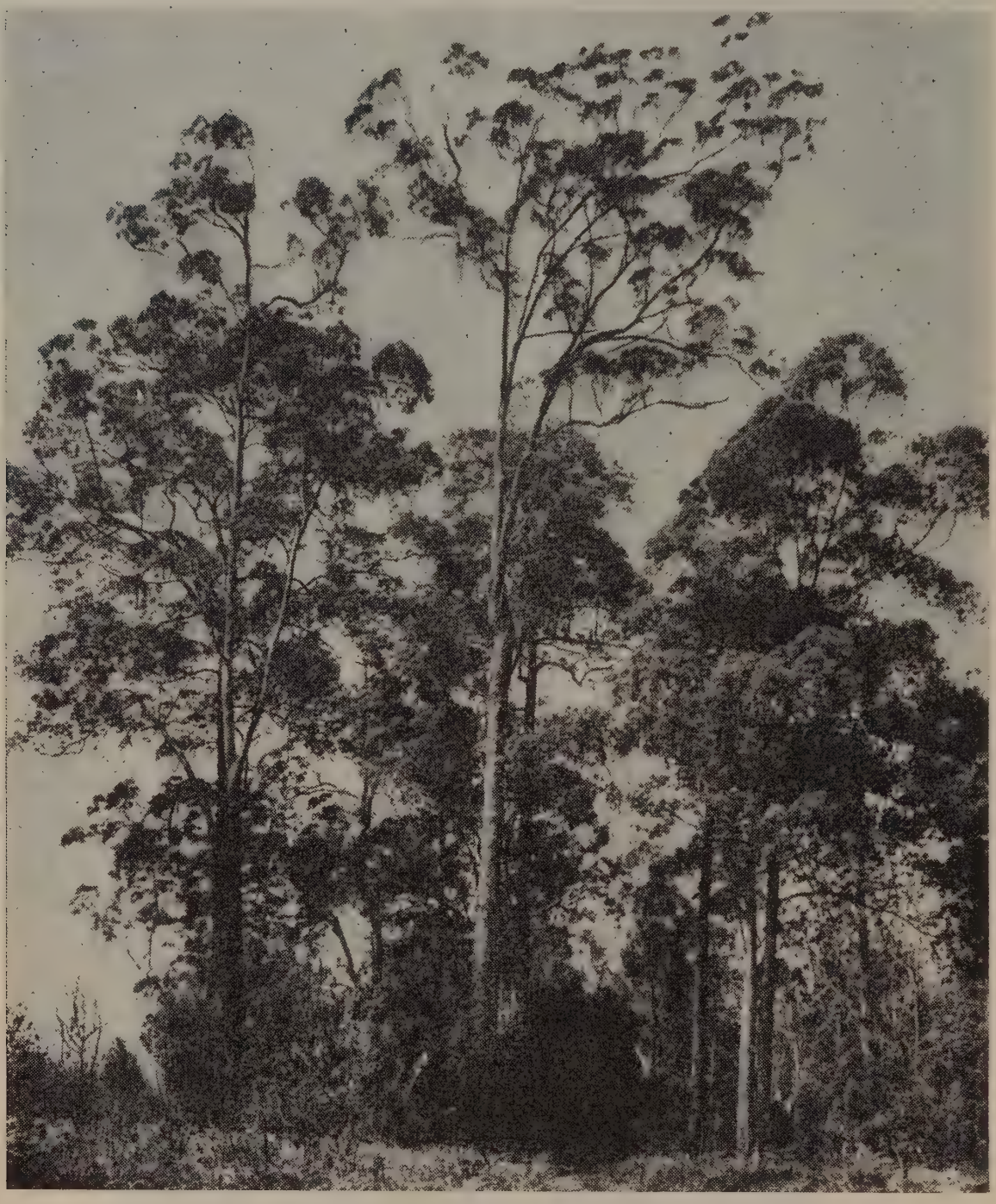


Plate 23.

White Bloodwood (Eucalyptus trachyphloia) at Caboolture.

Distribution.—In forest country in sandy or stony ground in south-eastern Queensland, sometimes rather common but mostly as scattered trees. It is also known from further north and south.

Usual Flowering Time.—February to April.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

General Remarks.—The somewhat inferior honey from this species, with the characteristic stringiness of bloodwood honeys, has poor density and only fair flavour. Often, it ferments shortly after extraction and, in fact, has been known to "blow" in the honeycomb. The first indication of fermentation is the gradual development of an unpalatable flat flavour, and when this is noticed, heat treatment of the extracted honey should be undertaken immediately. Normally, it granulates quickly with a grain that is coarse in appearance but soft in texture. The species provides some winter stores, and the pollen stimulates breeding.

[TO BE CONTINUED.]

RECENT BOOKS.

"Jute Substitute Fibres: Bimli-Jute, The Roselle and Aramina Fibre."
By A. E. Haarer.

In view of the interest in fibre growing now being shown in Queensland and other sub-tropical and tropical regions, this well-illustrated publication on kenaf, rosella and Urena fibres is very timely.

The climatic and cultural requirements of each of the three crops are discussed in detail, as well as its harvesting, retting and fibre extraction.

A chapter is devoted to diseases and pests of the three crops.

The book is published by Wheatland Journals Ltd., 356 Kilburn High Road, London, N.W.6, and the English price is 30s.

"Rural Australia. A Graphical Summary, 1952."

The Commonwealth Bureau of Agricultural Economics has prepared this book to show in graphical form first the general relationship of the Australian rural economy to the total economy of the country, and secondly the principal features of each of the major rural industries. It should prove a valuable reference in the libraries of secondary schools, universities and all who aim to be well-informed on our rural economy.

The book is distributed on behalf of the Bureau by Angus and Robertson Ltd., 89 Castlereagh street, Sydney. Its price is 21s. (postage 1s.).

SOIL CONSERVATION LITERATURE.

The following advisory leaflets on soil conservation are available to Queensland primary producers free of charge:—

No. 196. General aspects.
No. 197. Vegetation and water disposal.
No. 198. Contouring.
No. 212. Pondage and diversion structures.
No. 213. The prevention and control of gully erosion.
No. 226. Soil conservation in horticultural areas.

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TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 27th MAY, 1953.)

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus" Stud, Greenmount
	H. V. Littleton, " Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmer " Stud, Wondai
	W. G. Marquardt, " Springlands," Wondai
	A. C. and C. R. Marquardt, " Cedar Valley," Wondai
	A. H. Sokoll, " Sunny Crest " Stud, Wondai
	W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt
	G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, " Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	" St. Christopher's " and " Iona " Studs, Brookfield road, Brisbane
	E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, " Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount
	J. F. Lau, " Rosallen " Jersey Stud, Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, " Yarradale," Yarraman
	A. L. Semgreen, " Tecoma," Coolabunia
	G. & V. Beattie, " Beauvern," Antigua, Maryborough
	L. E. Meier, " Ardath " Stud, Boonah
	A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango
	F. W. Verrall, " Coleburn," Walloon
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	W. E. O. Meier & Son, Kingsford Stud, Alberton, *via* Yatala
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

ASTRONOMICAL DATA FOR QUEENSLAND.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

JULY

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.39	5.03	Cairns	9	49	Longreach ..	27	43
6	6.39	5.05	Charleville	25	29	Quilpie	37	33
11	6.39	5.07	Cloncurry	37	63	Rockhampton ..	1	19
16	6.38	5.10	Cunnamulla ..	31	27	Roma	15	19
21	6.36	5.12	Dirranbandi ..	22	16	Townsville ..	8	41
26	6.34	5.15	Emerald	12	28	Winton	29	51
31	6.31	5.17	Hughenden ..	21	49	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	9.28	9.36
2	10.32	10.12
3	11.35	10.46
4	..	11.21
	a.m.	
5	12.39	11.59
	p.m.	
6	1.43	12.40
7	2.48	1.26
8	3.52	2.18
9	4.52	3.13
10	5.47	4.12
11	6.36	5.12
12	7.18	6.10
13	7.55	7.07
14	8.28	8.02
15	8.58	8.54
16	9.26	9.45
17	9.54	10.37
18	10.23	11.29
19	10.54	..
		a.m.
20	11.28	12.24
	p.m.	
21	12.07	1.21
22	12.52	2.19
23	1.45	3.19
24	2.44	4.18
25	3.50	5.14
26	4.58	6.05
27	6.06	6.51
28	7.14	7.32
29	8.20	8.10
30	9.26	8.46
31	10.31	9.22

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	21	15	38	31	12	7	43	35
6	26	12	43	27	18	2	50	30
11	29	11	44	26	19	1	52	29
16	19	19	35	35	10	10	41	41
21	12	27	27	43	1	18	29	51
26	12	28	27	43	2	19	30	51
31	15	22	30	38	6	13	35	44

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	34	21	54	44	38	29	29	18
3	23	32	46	53	30	38	20	28
5	18	43	42	59	27	45	16	36
7	8	51	36	64	21	50	8	43
9	3	55	34	67	18	52	4	45
11	7	50	36	63	20	49	7	42
13	14	42	39	59	24	44	13	36
15	23	32	46	53	30	38	20	28
17	33	23	52	45	37	30	27	20
19	42	18	58	43	43	27	35	17
21	50	9	64	36	48	22	41	9
23	55	4	68	33	51	19	45	5
25	52	5	66	34	50	20	43	6
27	43	12	59	38	44	24	36	12
29	31	24	51	46	35	31	25	21
31	20	36	43	55	28	40	17	31

Phases of the Moon.—Last Quarter, 4th July, 8.03 a.m.; New Moon 11th July, 12.28 p.m.; First Quarter, 19th July, 2.47 p.m.; Full Moon, 26th July, 10.20 p.m.

On July 15th the Sun will rise and set about 25 degrees north of true east and true west respectively and on the 16th and 29th the moon will rise and set very close to true east and true west respectively. On July 5th the earth will be at its greatest distance from the sun.

Eclipses.—On July 11th there will be a partial eclipse of the sun but it will not be visible from Australia. However on July 26th there will be a total eclipse of the moon which will be seen from this portion of the earth. The time of commencement will be 8.32 p.m. and the time of ending, just after midnight. The duration of totality will be about 1¾ hours.

Mercury.—An evening object at the beginning of the month, in the constellation of Cancer, setting about 2 hours after the sun. It will be in conjunction with the sun on the 25th and at the end of the month, in the constellation of Gemini will rise ¾ hour before sunrise.

Venus.—Still a very brilliant object in the morning sky. At the beginning of the month in the constellation of Taurus will rise 3½ hours before the sun and on the 16th will pass Aldebaran and on the 23rd will pass Jupiter. By the end of the month, still in the constellation of Taurus, it will rise 2 hours 52 minutes before the sun.

Mars.—Still too close in line with the sun for observation.

Jupiter.—In the constellation of Taurus, at the beginning of the month will rise about 2 hours before the sun and at the end of the month will rise 3 hours 20 minutes before sunrise.

Saturn.—At the beginning of the month will set just after midnight and will pass Spica on the 26th. At the end of the month Saturn will set between 10.45 p.m. and midnight.

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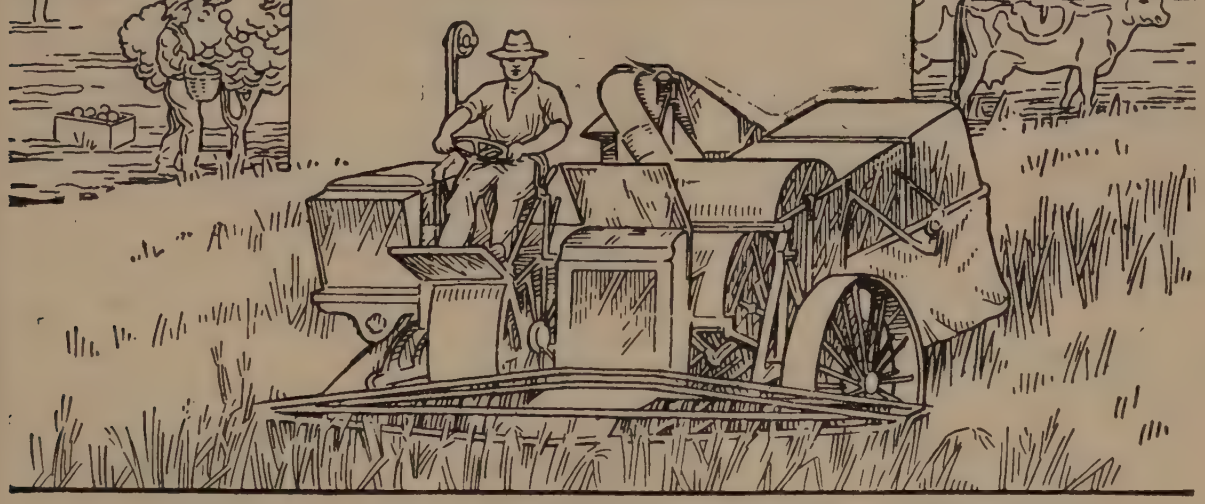
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FOR AGRICULTURE
AND STOCK



Edited by
C. W. WINDERS, B.Sc.Agr.



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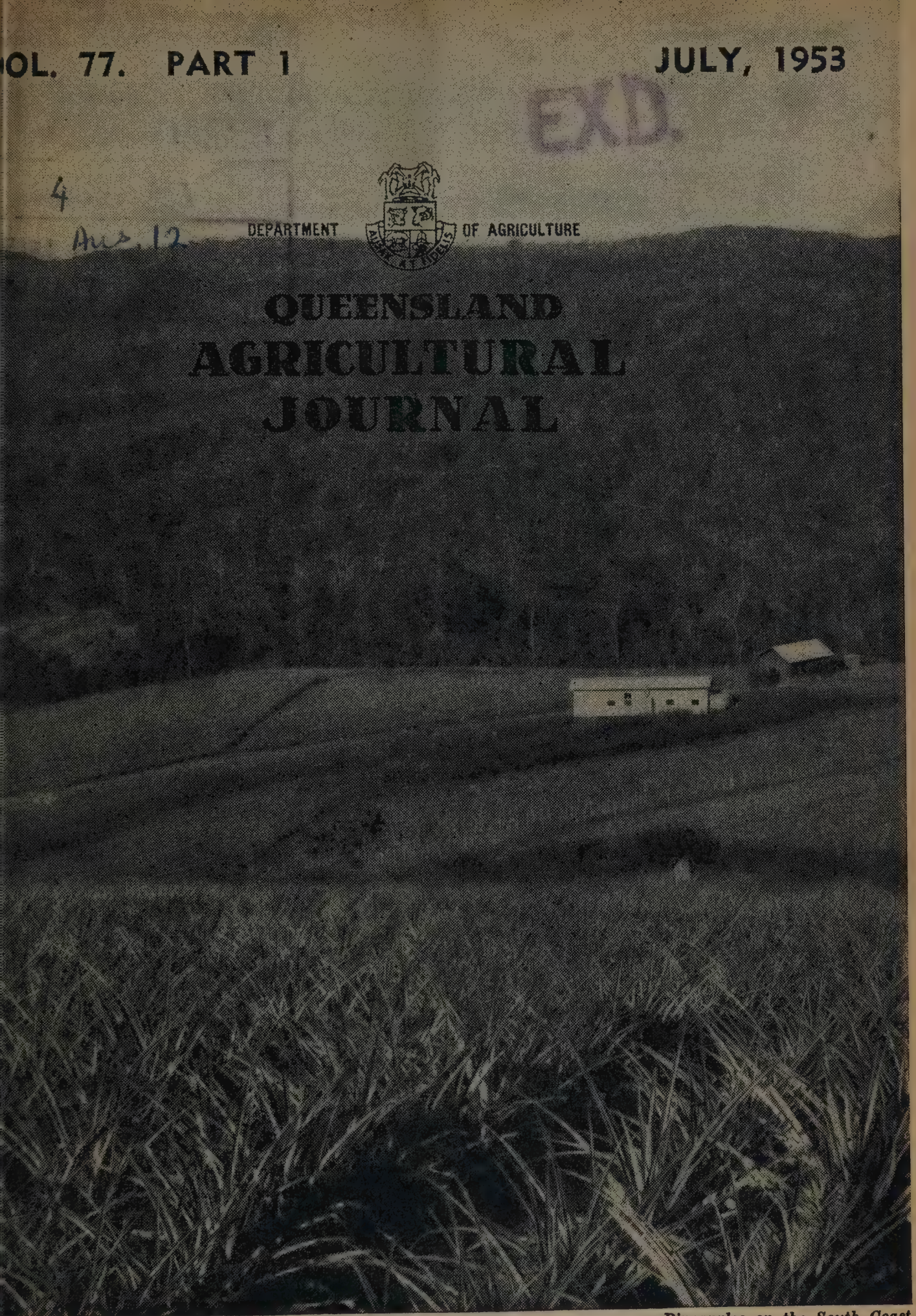
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Collar Rot of Apples
Trap Gate for Cattle
Lucerne Price Movements
Pig Feeding and Carcase Quality

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Pests of the Hive and Honeybee.

C. ROFF (Adviser in Apiculture) and A. R. BRIMBLECOMBE (Entomologist), Science Branch.

BEES, like most other living creatures, are subject to attacks by a number of enemies. Some of these take toll of the adult bees; others attack the brood, the comb or the hive. Although depredations on living bees are of casual occurrence, damage to combs and hives can become extensive and seriously affect the beekeeper's returns. This can be largely avoided, however, by the adoption of preventive or control measures.

WAX MOTHS.

Two closely related moths, the larger wax moth and the lesser wax moth, are by far the most troublesome apiary pests in all parts of Queensland. The former is the more destructive, and although the information given below relates particularly to it, the lesser wax moth has similar habits and may be controlled by the same methods.

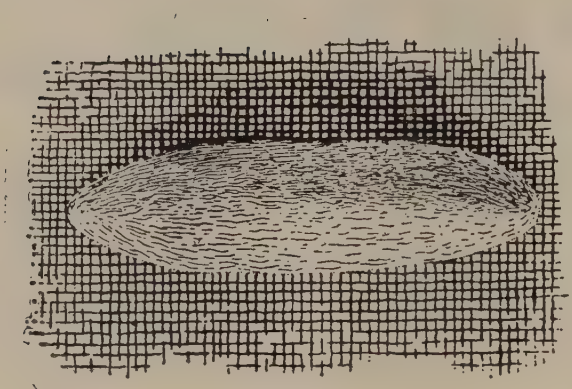
Life History and Habits.

Wax moths (Plate 1, figs. 5 and 6) are fawn coloured and have a wingspread of 1-1¼ in. They are most active after dusk, when the females enter hives by evading the guard bees, especially in the weaker colonies. A female may lay many hundreds of eggs, depositing them in masses in the darker places in the hive, mostly on the combs and between hive parts. The eggs (Plate 1, figs. 1 and 1a) are very small, globular in shape and white in colour. These hatch in about eight days, giving rise to small, pale-coloured larvae or grubs, which immediately tunnel into the comb, mainly to the position of the midrib. The tunnels are evident by broken cells (Plate 2) and are lined with silken webbing which assists the grubs to evade the bees when attacked by them. Larval movements within the tunnels are plainly visible when infested comb is held up to the sunlight.

The grubs are essentially pests of beecombs, but may also damage brood, frames and the hive. By tunnelling in the region of the midrib, they destroy the bases of the cells and ultimately may cause collapse of the comb (Plate 3 b). Sometimes the grubs work along the surface of the cells and expose the brood, or cause honey to leak out.



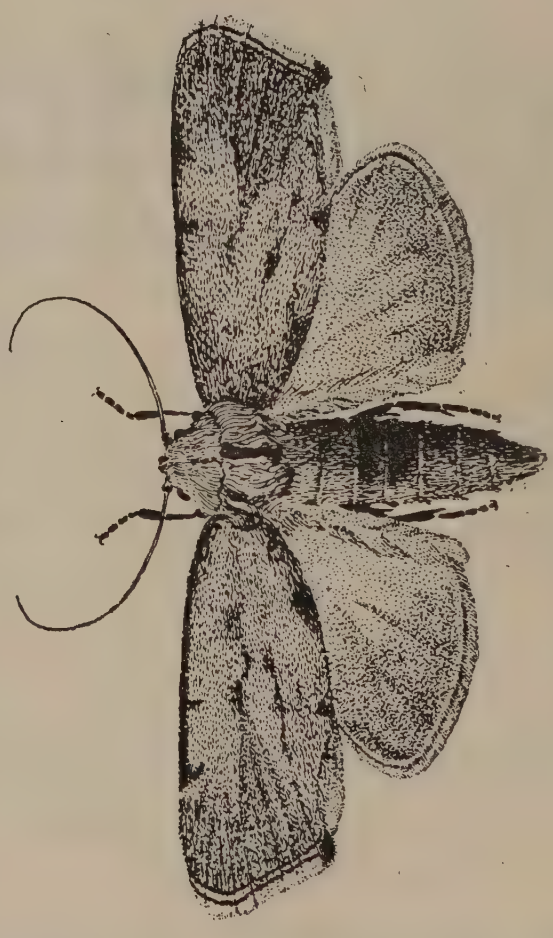


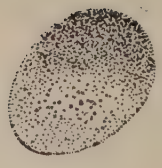












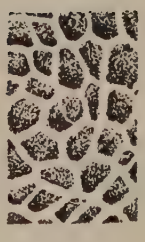


Plate 1.

Larger Wax Moth. Fig. 1, Egg x 30. Fig. 1a, Surface of egg x 210. Fig. 2, Larva, top view x 2. Fig. 2a, Larva, side view x 2. Fig. 3, Cocoon x 2. Fig. 4, Pupa, underside x 2. Fig. 4a, Pupa, top side x 2. Fig. 5, Adult female x $2\frac{1}{2}$. Fig. 6, Adult male x $2\frac{1}{2}$.

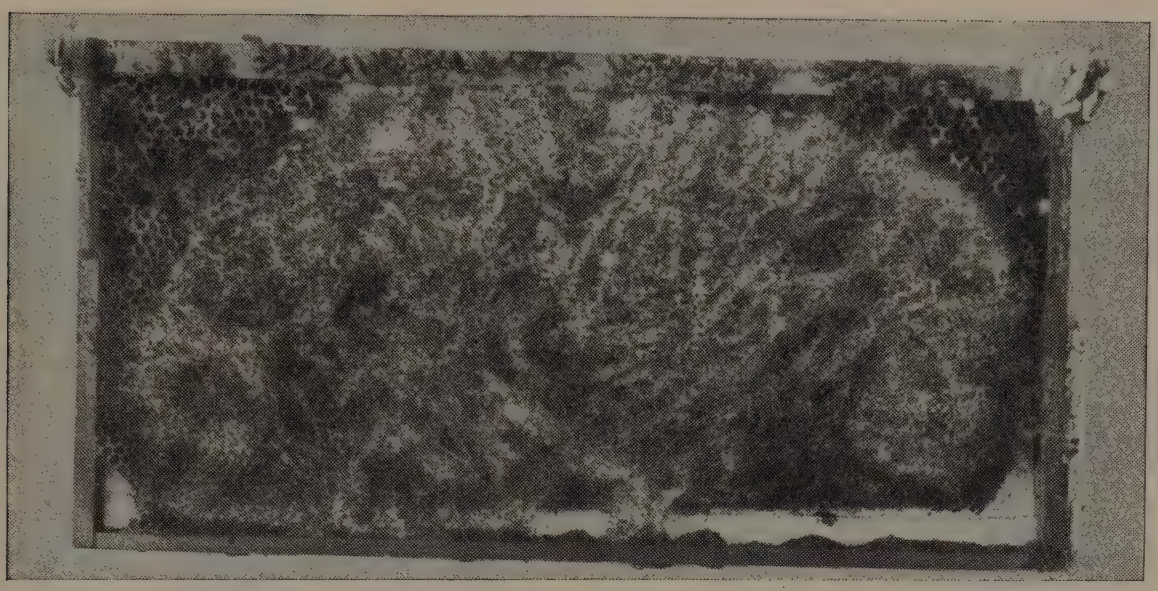
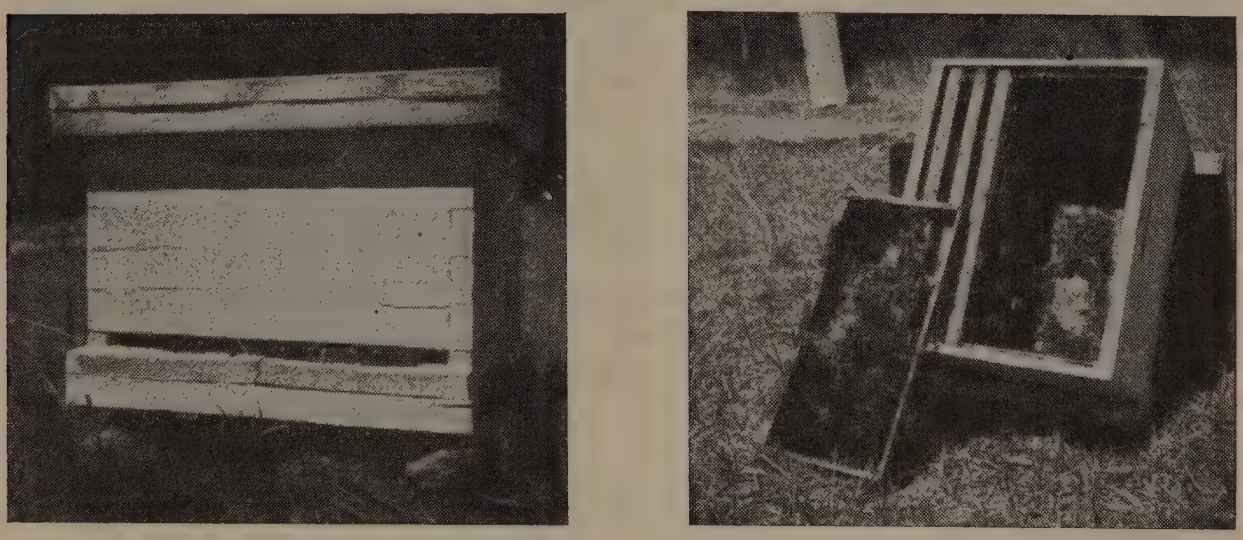


Plate 2.

Beecomb Damaged by Wax Moths. Cocoons are showing on the right side of the frame.

Damage is most severe in stored combs, whether in the apiary or storehouse. Infestations are also possible in active hives, where empty combs may be destroyed, brood killed and honey lost. In this way weak colonies become unproductive and eventually may be lost. In neglected apiaries serious damage soon develops and an early indication is debris blocking the hive entrance (Plate 3 a).



a b

Plate 3.

Wax Moth Damage. a, Wax debris blocking hive entrance. b, Damaged beecombs.

Larval development is most rapid in dark comb, particularly that containing brood or brood fragments. Feeding may occur on pollen cells, but more often these are avoided. Normally, the grubs cannot survive on pure wax and therefore white super honeycombs and foundations are seldom attacked.

Full-grown grubs (Plate 1, figs. 2 and 2 a) are grey in colour and almost an inch in length, and in warm weather their growth is completed in six to eight weeks. The change into the pupal stage (Plate 1, figs. 4 and 4 a) may occur in the comb, but usually the grubs crawl away to form the tough silken cocoon (Plate 1, fig. 3) on the top and side bars of frames (Plate 2) or on the hive walls. Prior to forming

cocoons, however, the grubs may make excavations into the wood, sometimes boring holes through the frames. The pupal period lasts about two weeks, then the adult moths emerge, mate and reinfest the combs within the hive or search for other hives.

Wax moths and their grubs are most abundant during the summer months, and it is in this period that damage is greatest. A few grubs may be present during the winter months working beneath odd pieces of burr comb and propolis in the less accessible places within the hive. Almost invariably one or more colonies in an apiary are infested, and if combs from these are directly stored either in supers or in the storehouse, damage will increase and spread quickly.

Control.

Strong colonies usually resist invasions by wax moths either by preventing the entry of the female moths or by attacking them or their grubs within the hive. Good beekeeping practices therefore are normally sufficient to ensure that beecombs in active colonies do not become infested.

Weak colonies rarely escape attacks and these may be determined by regular inspections. Surplus beecombs should be removed for storage and the hives scraped clean of all burr comb and propolis, which otherwise would provide protection for grubs.

All combs removed for storage should be fumigated with paradichlorobenzene (PDB) or carbon bisulphide. For this purpose they are placed in spare supers stacked five high in a single column with a wad of newspaper as a base to check the escape of the heavy fumes. The supers must be stacked as tightly as possible, the cracks being closed with strips of gummed paper.

When PDB is used, 3 oz. (six tablespoonsful) are spread over the frames of the top super, which is then well sealed with a pad of newspaper under a hive cover. The crystals of this material slowly change to fumes which sink through the supers, killing all larvae and moths present and also any larvae hatching later. Reinfestation is prevented by regularly replenishing the crystals, preferably at intervals of 2-3 weeks during warm weather. PDB is non-inflammable and non-explosive.

When carbon bisulphide is used, a dose of 1 fluid oz. (two tablespoonsful) is poured into a small, shallow container, placed in an empty additional super on the top of the stack; and again the whole is then well sealed with a paper pad and hive cover. This chemical kills larvae and moths as the fumes sink through the supers, but it does not remain effective sufficiently long to kill the later hatching larvae, and there is no residual repellant action against reinfestation. This treatment should be repeated at intervals of three weeks, especially during the summer.

Combs fumigated with either PDB or carbon bisulphide must be thoroughly aired before being replaced in working colonies.

Carbon bisulphide is highly inflammable and explosive. When this material is being handled, naked lights must be kept away and smoking prohibited.

ANTS.

Several species of ants often visit hives in the vicinity of their nests and take honey or pollen and even brood from the weaker colonies. Their persistence seems to cause the development of a tolerance amongst the bees and for this reason control becomes necessary. The more troublesome species are the coastal brown ant, the small black ant, the meat ant (Plate 4), and the sugar ant (Plate 5).



Plate 4.
Meat Ant.



Plate 5.
Sugar Ants.

The first two species are about an eighth of an inch in length and brown to black in colour. Their nests may be located almost anywhere on the ground, in the grass, or under stones, pieces of wood and other objects. The other two species are each almost half an inch in length. The meat ant has a metallic reddish-black colour. Its nests are usually conspicuous, gravel-capped mounds. The sugar ant is yellowish-black in colour and the nests occur under stones or logs.

The smaller species of ants breed quickly and may invade an apiary site. Their nests therefore are usually located under or near the infested hive. The larger species are more fixed in their nesting sites, and invade only for food.

Control.

Control of each species of ant is the same. The nests or mounds should be located and liberally watered with a 2·0% solution of chlordane. With the smaller species the treatment should include margins of several feet around the located nests, while with the larger species the solution should also be run down many of the nest openings. Periodical inspections should be made and further treatments applied when necessary. Exposed nests or mounds should be covered with old hessian sacks or grass so that the chlordane will not be a danger to the bees themselves.

MICE.

During winter, mice enter storage supers or weak colonies mainly for protection. In active hives their presence disturbs the colony during the inactive winter period and they mutilate combs by feeding and nesting (Plate 6). If they occupy an upper super the lower ones are fouled and are unacceptable to the bees.

Control.

Strong colonies resist mice when these pests attempt to enter the hives. Other colonies can be protected by any one of the following methods:—

(1) Place a queen excluder between the brood chamber and the bottom board.

(2) Reduce the width of the entrance to three-eighths of an inch.

(3) Fasten a strip of queen-excluding zinc or wire over the hive entrance.

Supers containing stored combs should be tightly stacked and all openings blocked against entry by mice.

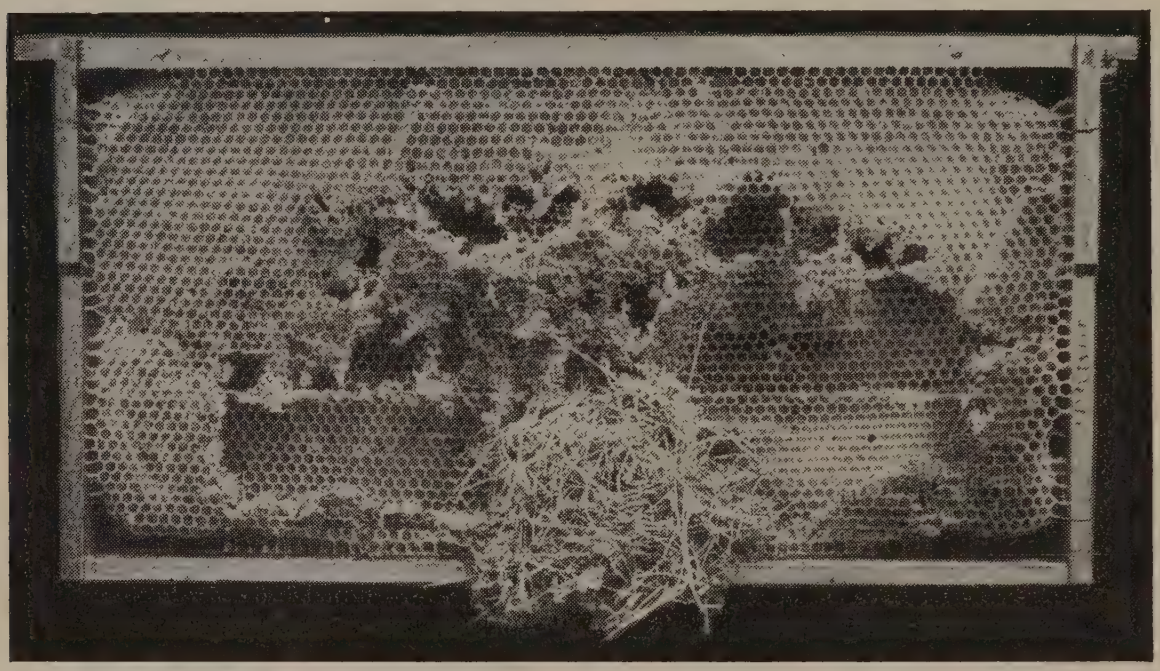


Plate 6.

Mouse Nest Built in a Beecomb. Wax moth damage is also evident.



Plate 7.

White Ant Damage to Hive.

WHITE ANTS.

In some parts of the State, especially in the south-eastern districts, white ants attack the hives and cause considerable damage by eating away the wood (Plate 7), particularly the bottom board, which in many instances may be resting directly on the ground. The troublesome species inhabit the soil and are not always evident by mounds.

Control.

White-ant damage can be prevented by coating the underside of the bottom boards with a pentachlorophenol solution prior to painting or alternatively by painting this surface annually with creosote.

OTHER ENEMIES.

Bees are attacked by a number of predators. Although these pests merely capture individual bees they are often persistent and are voracious feeders.

Giant toads may congregate near apiaries and snap up bees entering or leaving the hives and in this way weaken colonies. These pests can be checked by placing the hives on stands at least two feet high or by fencing the apiary with ½ in. mesh wire netting.

The rainbow bird and wood swallows at certain times of the year flock around apiaries and feed upon field bees. This can affect the working strength of an apiary if forage conditions are poor and brood-rearing is slow. When these birds are troublesome it is better to move the apiary to a more favourable location.



Plate 8.

Dragon Fly.



Plate 9.
Robber Fly.



Plate 10.
Assassin Bug.

Dragon flies (Plate 8) and robber flies (Plate 9) take toll of field bees on the wing and the assassin bug (Plate 10) may seize some of those visiting flowers. The well known and venomous red back spider also captures an occasional bee.

Two species of mites occasionally invade colonies and infest the bees. Their presence irritates the bees but does not seem to have any detrimental effect on colony strengths.

Scientific Names of Pests.

Assassin bug	*Pristhesancus papuensis* Stal.
Coastal brown ant	*Pheidole megacephala* (F.)
Dragon flies	Species of *Hemianax*
Giant toad	*Bufo marinus* L.
Larger wax moth	*Galleria mellonella* L.
Lesser wax moth	*Achroia grisella* Fab.
Meat ant	*Iridomyrmex detectus* (F.Sm.)
Mites	*Pediculoides ventricosis* (Newp.) and *Hypoaspis* sp.
Mouse	*Mus musculus* Linne
Rainbow bird	*Merops ornatus* Latham
Red back spider	*Latrodectus hasseltii* Thorell
Robber flies	Species of *Promachus*
Small black ant	*Iridomyrmex rufoniger* Lowne
Sugar ant	*Camponotus nigriceps* Sm.
White ants	*Coptotermes acinaciformis* Frogg. and *C. lacteus* Frogg.
Wood swallows	Species of *Artamus*

PLANT PROTECTION

Collar Rot Disease of Apples.

T. McKNIGHT, Pathologist, Science Branch.

OVER the last five years a collar rot disease caused by the fungus *Sclerotium rolfsii* Sacc. has been responsible for numerous losses in apple orchards on granitic sands and sandy loams in the Stanthorpe district. Losses as high as 60 per cent. have occurred in young orchards.

Collar rot is regarded as a major cause of the death of young trees in orchards. The fungal nature of the disease is commonly overlooked, and too shallow or too deep planting, either heat girdling or frosting, or either too early or too late planting, is held responsible for the death of the trees.

The disease is particularly severe on old land that has been repeatedly cropped to vegetables. It appears most frequently in trees two to three years old but it has also been recorded attacking trees up to 14 years of age. Varieties of apples found infected in the field up to the present are Granny Smith, Delicious, Lord Nelson and Gravenstein.

Symptoms.

The fungus attacks the trunk at, or just below, ground level, where it produces a rot. A prominent white weft of fungal strands may be present over the diseased area when the soil is moist, but a definite diagnosis of the disease is made by the presence on the crown area, in the soil nearby, or on the roots down to five or six inches, of the brown, round or slightly irregularly shaped sclerotia or resting bodies of the fungus. These resting bodies resemble radish seed (Plate 1).

One side of the trunk is attacked first, and the leaves on limbs on this side quickly show the presence of the disease by turning a characteristic reddish or greyish-purple colour and wilting. The leaves then become dry, papery and brown in colour. The fungus produces a rot of the bark and woody tissues which gradually encircles the stem, cutting off the flow of water and nutrients, and the tree dies (Plate 2). Rarely, a tree may show a sudden collapse involving the whole tree.

Cause.

Isolations from the rotted areas on apples have given cultures of the fungus which reproduced the disease on inoculation. The fungus from the apple produced larger sclerotia than those usually produced on vegetable crops affected with the same disease. However, inoculation tests have shown that fungous cultures obtained both from apples and from vegetables (carrots) are able to produce a collar rot of apples. It has been demonstrated that uninjured apple seedlings, of Merton and of seedling stock, inoculated in June, will die within six months if the sclerotia of the fungus are placed in soil 1-1½ inches from the crown.

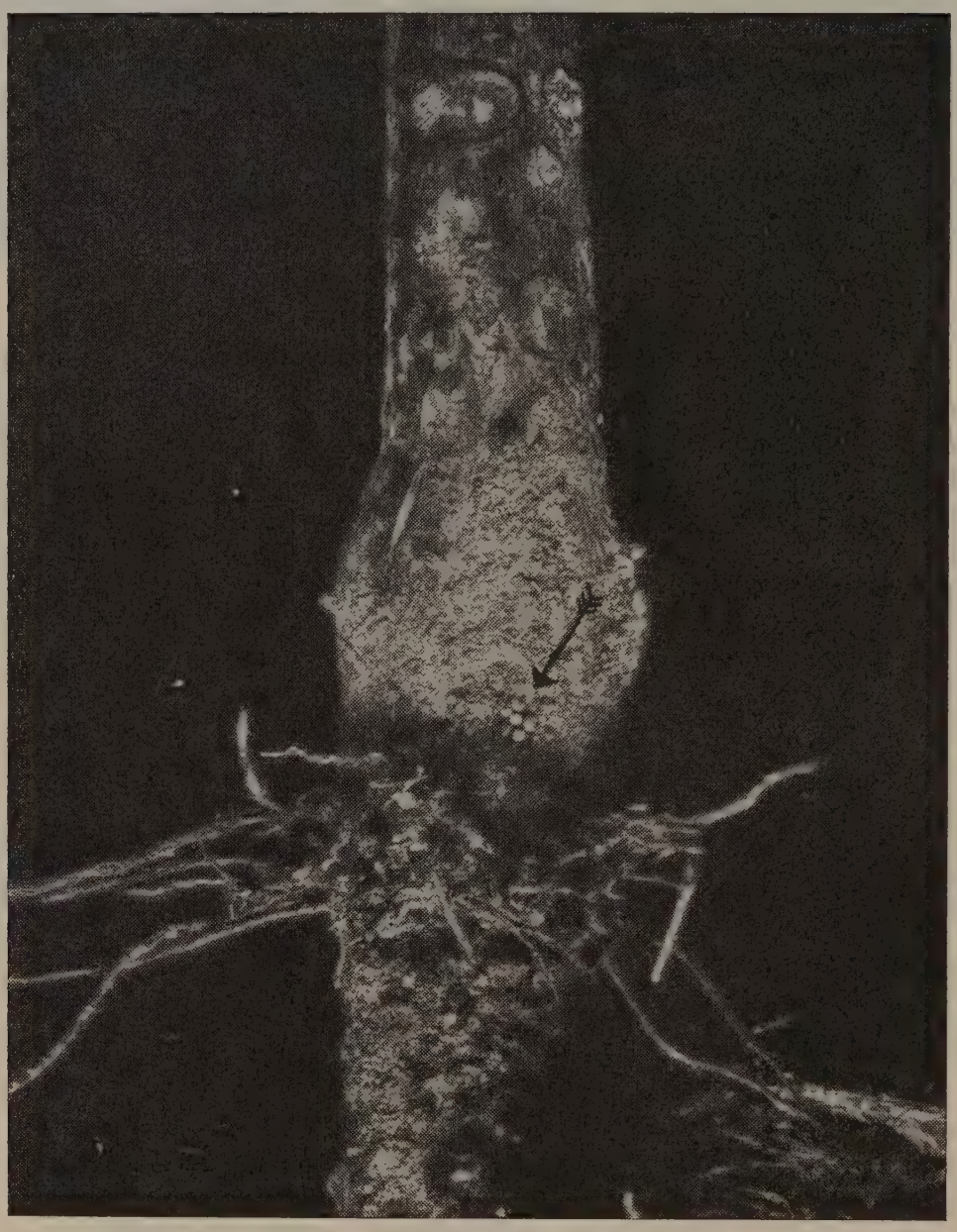


Plate 1.

An Infected Apple Crown, Showing the Sclerotia of the Fungus Occurring on the Surface at the Point Marked by the Arrow.

Control.

Badly drained areas of the orchard should be avoided when planting apples, as such areas are conducive to the development of this fungus.

The sclerotia of the fungus are distributed through the soil during cultivation. The same fungus causes crown rots in vegetable crops and New Zealand blue lupin and is commonly observed attacking such crops interplanted in infected orchards.

The history of old vegetable land with respect to crown rots should be carefully considered before such land is converted to an apple orchard. In this respect, Stanthorpe officers of the Department of Agriculture and Stock should be consulted at least one season before planting is considered.



Plate 2.

An Infected Apple Tree with the Bark Cut Away from the Base to Show the Rot Penetrating the Wood. This should be removed in the surgical treatment described in the article.

It is thought possible that infection may sometimes be present on the planting material. Accordingly, a very careful examination should be made for the white fungus and the brown sclerotia on the roots of the young trees before they are planted out. Any infected trees should be carefully removed and burnt and the remainder dipped in Bordeaux mixture, Cheshunt mixture, or a suspension of one of the proprietary copper sprays before planting out.

Careful and regular examinations should be made after the trees are set out. On the appearance of the first symptoms of the disease in the leaves, the soil should be removed from the crown to expose the infected area. This area should then be cut away with a sharp knife until clean, healthy tissue is revealed, when the area should be covered with a thick paste of either Bordeaux mixture or one of the proprietary copper sprays. Cheshunt mixture may also be used to treat exposed tissues and the surrounding soil. The soil should be kept removed from the crown for several weeks, or up to 10 weeks, by which time the area will be effectively covered with callus tissue. During this period, depending on weather conditions, it may be found necessary to renew the application of copper paste over the cut area.

This method appears to be effective if the disease is detected early enough—that is, before the infection has involved a considerable area of the trunk.

New Zealand blue lupins should not be used as a cover crop in an infected orchard as they may assist in the multiplication of the fungus in the soil and also in its distribution. As an alternative, rye or wheat should be sown.

Growers who require further advice on this disease should contact the Department of Agriculture and Stock in Stanthorpe.

Formula for Cheshunt Mixture.

Powdered bluestone (copper sulphate) .. .. .. 2 parts.

Fresh powdered rock ammonia (ammonium carbonate) 11 parts.

If necessary, crush the bluestone and rock ammonia to a fine powder. Thoroughly mix the two together in the correct proportions and keep in a tightly stoppered glass or earthenware vessel for at least 24 hours before using.

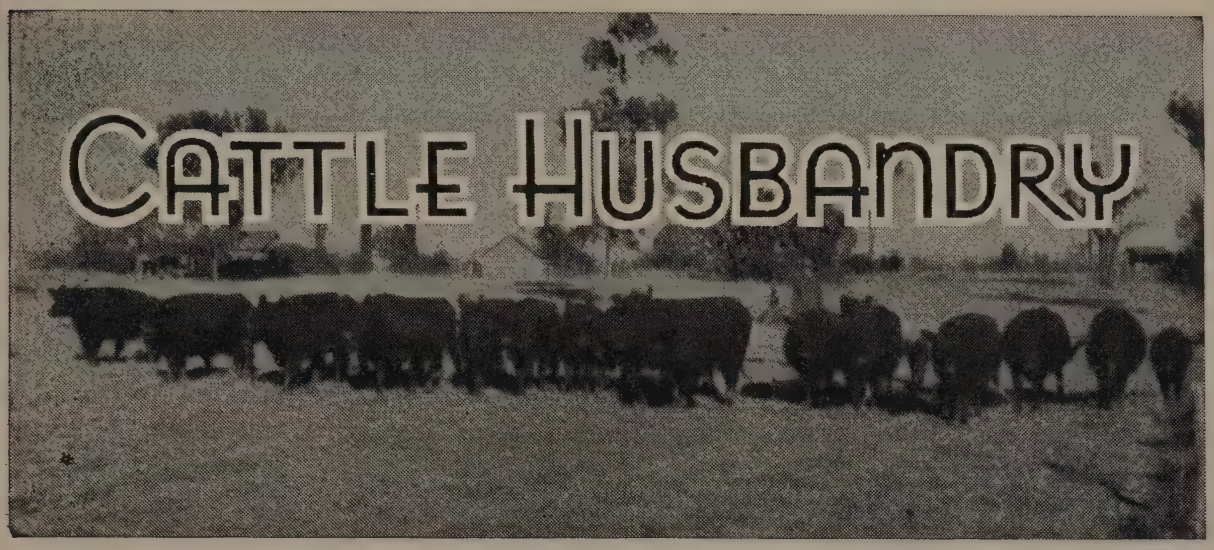
For use, dissolve the dry mixture in water at the rate of 1 oz. to 2 gallons. Water this solution on the soil so as to wet it thoroughly.

Wash out the can after use, since the solution will corrode metals.

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The Selection and Breeding of Dairy Cattle.

R. D. CHESTER, Officer in Charge, Cattle Husbandry Branch.

THE key to successful dairy farming is the individual cow. The healthy, long lived, fertile, high producing cow is the foundation on which a prosperous dairy industry must be built and it should be the aim of every good farmer to maintain a herd of such animals. This is not easy to do, and when by careful breeding a farmer succeeds in getting together a good herd, it becomes a matter of vital importance that he be able to maintain the herd at the high standard achieved. It is, therefore, very necessary that the best cows in the herd should have the capacity to pass on to their daughters these qualities of health, longevity, fertility, and high production.

In order to maintain an efficient high producing herd, the farmer must give close attention to the theory of breeding and the practical application of herd recording and breeding techniques to the management of his herd. A farmer's ultimate success as a breeder depends upon his skill in the selection and mating of animals. The term selection as applied to dairy cattle breeding means the choosing of males and females in one generation of cattle as parents for the next generation. Only the best material should be used if worthwhile progress is to be expected. Mistakes in selection, if not detected early, may easily ruin a good herd.

In selecting dairy animals for breeding purposes, milk and butterfat records must be taken into consideration along with type and conformation. Some dairymen consider production records to be all-important; others make selections entirely on type. The wise man places the greater emphasis on production records but at the same time does not lose sight of the importance of conformation.

Shows have been strongly condemned by many leading animal breeding authorities and the opinions of these authorities have been severely criticised by stud breeders. There is nothing fundamentally wrong with such a state of affairs. Out of controversy comes closer examination of the subject and progress is made towards better methods of measuring worth in dairy cattle.

Cattle shows play an important part in the life of those engaged in the industry and in the progress of that industry. The competition inseparable from shows can inspire stud breeders as well as commercial

dairymen to improve their stock by providing an ideal towards which to work. The agricultural show can be a most important field of education, particularly for young farmers. Nevertheless, since profitable production is the goal of all work with dairy cattle, it is important that judges and show societies should place emphasis on production performances.

Emphasis on fancy points which bear no relation to production does much to destroy the usefulness of shows. It is apparent that in Queensland show-rings far too much attention is still given to unimportant features and far too little consideration to lifetime production performances. Wise breeders will avoid selecting animals according to present show standards alone. Breed societies should strive to modify judging methods in order to stress the economically important features of show-ring contenders.

Under present judging systems, a cow has no chance of winning a prize if she has a serious defect in body conformation no matter how good her production record may be. Cows are judged on their physical appearance and bodily condition at the time of judging. Moreover, show judges do vary in the relative values they place on particular points of conformation and so the personal element is bound to intrude to some extent.

Undue emphasis on type, particularly in the case of bulls, greatly reduces the educational value of shows, and indeed may be the means of fixing fallacious ideas in the minds of young farmers. The judging of dairy bulls is the least satisfactory feature of shows. Judging them on conformation and masculinity may be quite misleading where breeding worth is concerned. One of the greatest evils associated with shows is that top show winners are frequently sold as sires regardless of their actual merit for breeding.

It is the opinion of some dairy farmers that successful studmasters have a sort of sixth sense which enables them to plan bull-cow matings more efficiently than ordinary people. Be that as it may, some breeders have outstanding success. On the other hand, any breeder can be assured of improved results by working to a plan. In the case of dairy cattle, there is sufficient scientific knowledge on which to work to enable any man with a good practical knowledge of stock to make a success of breeding.

The breeding methods adopted will vary according to the requirements of the individual breeder. The stud breeder will often adopt methods quite different from those of the commercial dairyman, and there are very good reasons why he should do so.

If the stud breeder is a show exhibitor, intent on winning as many prizes as possible, he may adopt a policy of making frequent purchases outside his herd in an effort to obtain cattle with outstanding show type. Provided he is a good judge, he can buy cattle out of condition relatively cheaply, take them home, feed and groom them and turn them out as show champions. Exhibitors tend to use wide outcrosses in breeding for show animals in the hope of getting an occasional outstanding animal. This type of selection does not lead to uniformity of type within the herd, and the progeny of show champions produced in this way will frequently be greatly inferior to their ancestors and therefore disappointing to the purchaser.

The second class of stud breeder is concerned less with shows than with the development of a uniform type and uniformly high production within his herd. He will purchase very few animals from outside, and then only animals which bear some relationship to his own cattle. He will breed within family groups in his own stud, with the object of purifying the strain of his cattle so that they will breed more truly for type and production; he will practise line breeding at all times and inbreeding quite frequently. His aim is to breed high producing families of cows and to sell bulls which will sire daughters of above average production capacity.

The commercial dairyman aims at maintaining a good herd of high producing cows. His aim always is to get the production of the worst 25 per cent. of his cows up to the herd average. He cannot afford the risk of inbreeding to maintain uniformity and so must depend on the purchase of proven bulls or sons of proven bulls from studs of known breeding worth. As far as possible, he will save all his female replacements from cows with production above the herd average. The importance of a good bull in the herd of a commercial dairyman cannot be over-stressed.

THE MECHANISM OF INHERITANCE.

The animal body is made up of minute cells and these cells are divided into two classes—(1) the body cells, which are concerned with the structure and composition of bone, muscle and other body tissues; and (2) the germ cells, which are concerned with reproduction.

All cells irrespective of their class contain the substance chromatin, in which the factors responsible for inheritance of body characters are located. These factors are known as genes. The genes are grouped together in a number of rod-like bodies called chromosomes.

Genes are responsible for each character of the animal. A character such as horns may be controlled by a single pair of genes in the chromosome, but most characters, including important economic ones, are controlled by a combination of a number of pairs of genes. Milk production in dairy cows is such a character. Characters depending on a single pair of genes are much more easily controlled by the breeder than are those depending on gene combinations.

All body cells, as distinct from reproductive cells, contain chromosomes arranged in pairs and the genes in each member of a pair correspond. These paired genes act together to modify body character. One gene of each pair comes from the sire and the other from the dam, as will be clear from what follows.

Growth of the animal body is brought about by repeated division of body cells. In the process of growth, body cells divide in such a way that the chromosome content (and hence gene content also) of each new cell is the same as that from which it was derived. This is because each chromosome divides along its length, thus making the original number of chromosomes available for each daughter cell.

In the process of reproduction, on the other hand, the male (or, as the case may be, female) germ cells (called spermatoza and ova respectively) contain only half the number of chromosomes of ordinary body cells. This is because in dividing to form germ cells the body cells do so in such a way that the chromosome pairs simply separate into two equal groups each containing half the original number. There is no division along the length of the chromosomes.

When union of spermatozoa and ova takes place, in the act of fertilization, the original number of chromosomes is restored, half being derived from the male parent and half from the female parent. Thus the new individual has the same number of chromosomes as its parents.

One particular member in a pair of genes may be dominant to the other member, and in this case the one gene is called a dominant and the other a recessive. In other cases each gene may have a modifying effect on the other, and they are said to blend. In some cases both genes of the pair may be exactly similar.

Animals in which a particular pair of genes is made up of two identical genes are said to be *homozygous,* or pure, for the particular character controlled by this gene pair. In such cases all the animal's reproductive cells will contain the same type of gene for the particular character concerned; but where the gene pair is made up of two dissimilar genes, one half of the reproductive cells will contain one type of gene and the other half a second type. Just which type is passed on to the new individual is purely a matter of chance. The animal in this case is said to be *heterozygous,* or impure, for this particular character.

The term "purebred" as applied to cattle is therefore a relative one, indicating that animals so labelled are homozygous or pure for certain genes and gene combinations. They are, in fact, usually pure for factors controlled by single genes as opposed to factors controlled by groups of genes. These single gene characters are unfortunately usually factors of little economic importance. Purebred cattle are also relatively pure for many characters controlled by groups of genes, and although there may be variation within breeds for these characters, the variation is much less than for cattle that are not purebred. Such factors as body size and shape, udder conformation and milk production may be considered as examples of these factors. The Ayrshire breed, for instance, has a gene pair which is homozygous for horns. It also has groups of gene pairs which show only slight variation and which influence udder shape and milk production.

TYPE AS AN INDICATION OF LIFETIME PRODUCTION.

Farmers generally and stud breeders in particular are of the opinion that a cow's ability to produce milk can, at least to some extent, be related to what is called dairy type. By dairy type is meant certain anatomical features which have been selected by breed societies as typical of the good dairy cow.

Scientific workers in animal husbandry have given a great deal of time and research to efforts to correlate specific features of conformation with milk production. Most of these investigations have failed to show any convincing relationship between specific points of type and the cow's production ability, yet many people with a reasonably good knowledge of dairy cattle can select a cow capable of high production from one capable of producing only poorly or moderately. At least this selection can be made with reasonable accuracy after the cow "springs," though it is very doubtful if such would be the case if the animals being selected were heifers only 12 or even 18 months of age.

Research in America on this problem has clearly shown that some show judges are reasonably good judges of production in mature cows on a type basis, while others often fail in their efforts to judge for production on that basis. In view of the fact that in many cases these recognised competent show judges fail to select high producers on type alone, it is obvious that careful consideration should be given to production figures before purchasing dairy cattle if it is desired to acquire females capable of producing above average for the breed.

Some breed societies have classification systems in which registered animals within the breed are classified into a number of groups according to type. A comparison of type classification and production records available for classified animals indicates that, on the average, cows with the highest type classification are also the highest producers. This would appear to be an argument in favour of selection according to type. Undue weight should not be given to this finding, however, as cattle are classified when mature and in some cases the classification judges have prior knowledge of the cow's production. Because of this knowledge their judgment may be influenced when a decision is to be made.

Some breed societies provide for a cow to be resubmitted for classification after production records are known. A higher classification may then be given, thus demonstrating that the earlier classification based on type and conformation failed to assess the animal at its true worth.

On the basis of all the evidence available, it can be stated that there is some positive correlation between type in mature cows and production, but the correlation appears to be small. This means that by selection on type one would have a slightly better chance of getting above average producers than if one merely took a run of the cattle in a herd. On the other hand, it has to be recognised that some cows of excellent type might be poor producers and some excellent producers might be inferior in type.

Because herd recording and advanced register testing have had such limited application in Queensland, the farmer is forced to rely on every means that can afford some assistance in making his selection. As type is associated with production, even if only to a small extent, due recognition should be given to selection by this method.

A major error which can be made when selecting according to type is to rely on outdated ideas or fancy points which have been shown to have no bearing on production.

Undue emphasis is often given to milk veins because certain writers have considered that the size of these veins is an external indication of the amount of blood that passes through the udder, but the external milk vein is only one of the paths by which blood drains from the udder. Blood also passes by internal veins not visible to the judge. The size of the milk vein is therefore not a reliable guide as far as blood flow is concerned, and this being so, the foundation for judging cows on milk vein development is unsound. It is incidentally not entirely clear why breed societies insist on the milk vein being tortuous. There was once a theory—now largely discarded even by the most biased exponent of type selection—that the width of the escutcheon was an indication of production ability. The dairyman must avoid selection on the basis of these fallacious ideas.

Horn growth and development is just one fancy point which is worthy of mention. Distinctive horn development can give an added appearance of uniformity to a dairy herd and as a point of beauty is to be commended, but if good producers are culled because of cocked horns, great harm can be done to breeding programmes and to the dairying industry as a whole. It is necessary to remember in this connection that some breeders train the horns of their animals with mechanical devices of one sort or another to ensure that they conform to approved standards. The folly of such practice from the production standpoint is obvious.

All dairy cattle are better producers when they have no horns and it should be the aim of every true dairyman to dehorn both males and females during the first two weeks of life. The adoption of dehorning as a general practice rests largely with breed societies.

In selecting stock on type and conformation, chief consideration should be given to body characters which can be associated with health and general well being. Good dairy cattle must be able to move freely (walk well), have large internal capacity for the vital organs, have the ability to thrive under reasonably good conditions, and have a hair covering suited to the environment. They should have room for extensive attachment of udder to the body. The udder itself should be long, wide and deep, with attachments extending well up behind and far forward; the quarters even and with no marked indentations between the teats. The latter should be of such size and shape as to enable easy but firm attachment of milking machine cups. It is of great importance that a cow milks freely and completely by machine without the necessity for hand stripping.

Since the dairy bull is responsible for just half the hereditary composition of all his daughters, his selection is of paramount importance. Even when full records of past and present generations are available, the farmer must still exercise considerable judgment in selecting his herd sire. Generally speaking, animals which are well balanced in all respects should be selected. Concentration on one particularly good characteristic at the expense of other features is likely to have poor results. On the other hand, each additional character for which selection is made reduces the intensity of selection. Thus only economically important features should be considered.

THE EFFECT OF ENVIRONMENT.

It is not possible just by looking at an animal or studying its production record to know to what extent type or production has been affected by heredity and environment.

Environment, including climate, management, feeding and disease, plays a tremendous part in determining the differences between dairy cows in Queensland. For instance, the average production per cow in Queensland is less than 120 lb. of butterfat per year, but it is quite certain that the inherited potential of Queensland cows to produce butterfat in a more favourable environment is much higher.

It is important to keep in mind the fact that strains of cattle can be bred which are more suited to the environment than are other strains. As far as possible, dairy sires should be selected from studs in the district in which they are to be used.

Because of the importance of environment in animal breeding, the farmer must always be on the alert to detect environmental influences which may be lowering the potential production of his herd. Cattle bred for high production may be no more profitable than "scrubbers" if they are not given favourable conditions in which to produce.

American workers claim that, in pure breeds of dairy cattle kept under average to good conditions, only 20 to 30 per cent. of the variation in production is due to heredity, the remaining 70 to 80 per cent. variation being due to environment.

THE IMPORTANCE OF HEALTH AND FERTILITY.

The first consideration in establishing and maintaining a high producing dairy herd must at all times be the health and fertility of the herd. A high producing cow or a progeny tested bull is a liability rather than an asset in a herd if it is infected with disease or if it fails to breed regularly. Sterility is one of the major sources of economic loss to the dairying industry in Queensland, and the progressive dairyman must at all times be prepared to cull cows which prove troublesome to settle, or bulls which on the average fail to get at least one calf per two healthy cows served. *Should a cow fail to conceive after three services by a fertile bull, veterinary assistance should be sought by the farmer in order to diagnose the source of trouble.*

The purchase of aged proven bulls is a highly valuable means of herd improvement, though there is a risk of such bulls introducing disease into the herd or proving poor calf getters. The risk can be minimized if, before making such purchases, full enquiries are made concerning the health history of the herd from which the bull is to be purchased. At the same time, the buyer should be fully persuaded



Plate 1.

The Production of the Individual Cows in the Herd Can Only be Assessed by a Programme of Herd Recording and the Keeping of Accurate Records over a Period of Years.

that the bull is, in fact, getting a reasonable percentage of cows served in calf. It is, of course, very desirable that such bulls be tested for tuberculosis and brucellosis before introduction.

Despite the fact that progress in veterinary medicine in recent years has been so rapid that many serious diseases can now be controlled effectively by means of vaccines and drugs, the progressive dairyman should endeavour to secure naturally fertile, healthy animals and avoid at all costs introducing disease.

METHODS OF SELECTION.

When selecting animals from which future generations are to be bred, there are broadly three different approaches which can be made.

Animals may be selected according to:—

(1) Individual merit, the worth of the animal being based on its appearance (type and conformation) and, in the case of a cow, its production record.

(2) Pedigree.

(3) Performance and/or appearance of progeny.

Dairymen may from time to time use each method of selection or any combination of these methods, depending on circumstances and on the information available.

Selection According to Individual Merit.

Selection according to individual appearance and production performance is known as *phenotypic* selection. It is selection on the face value of an animal and does not give any consideration to ability to consistently transmit desirable characters to the progeny, this being left to chance.



Plate 2.

A Cow with Good Type and Production. The possible merit of her offspring can only be assessed by considering her pedigree and production of her half sisters. The appearance and performance of the cow is not in itself sufficient evidence on which to make selection of her son as a potential herd sire.

It is the simplest of all methods of selection, requiring no elaborate system of recording. Single measurements of production may, however, be very misleading. Thus 24-hour or 48-hour milking records are unreliable as a measurement of the milking capacity of an individual cow. Regular tests over a 273-day period give a more accurate idea of a cow's capacity to produce, though 305-day tests are preferred because a cow may normally be expected to produce for 10 months and remain dry for two months each year. Records of several lactations or lifetime production records give more accurate information about a cow's ability than single lactation tests. Information of this sort is now being made available in the Register of Merit published by the Department.

Single lactation records may be greatly affected by factors such as sickness and drought or the plane of nutrition (quality and quantity of feed) generally. It will be readily appreciated that in such cases a single lactation may give a quite erroneous impression of a cow's worth.

The practice of saving heifers for herd replacement only from the high producing cows in a herd is an example of phenotypic selection. It is a practice on which a considerable amount of research has been undertaken to determine its value. Production improvement by this method of selection is disappointingly slow. It has been shown both in America and in New Zealand that daughters of cows with production above herd average are likely to inherit only 15 per cent. of their dam's ability to produce above herd average, and that daughters of low producing cows will inherit only 15 per cent. of their dam's capacity for lower production. Thus in a herd with average production of 300 lb.



Plate 3.

The Production Potential of a Bull is Best Measured by Reference to His Daughters. Bulls should never be selected on type alone.

butterfat, cow A may produce only 200 lb. and cow B as much as 400 lb. On the average, the daughter of cow A would produce 285 lb. of milk and the daughter of cow B only 315 lb. of butterfat. In other words, there is in both cases a pronounced tendency for the offspring to revert to the herd average.

Selection of Bulls According to Type.

Where bulls are concerned, phenotypic selection has little application and wherever practicable one of the other two methods of selection referred to should be used in conjunction. Provided bulls do not show symptoms of disease or evidence of anatomical malformation or lack of development, little consideration should be given to type in making selections and the farmer should concentrate on pedigree and progeny tests. The production potential of a bull is best measured by reference to his daughters.

Selection According to Pedigree.

In Queensland, dairy animals are still selected in the first place on their individual merit, but when the progressive dairyman has made his preliminary selection on this basis, he then turns to the animal's pedigree in order to find what backing both in type and production the individual may have. A pedigree should reveal the show-ring and production records of an animal's ancestors.

There is a tendency for dairymen to purchase young bulls on pedigree alone without inspecting the production record of the herds from which they come. This method of selection may be sound enough when records of all animals in the pedigree are reasonably complete, but unfortunately this is not often the case with dairy cattle pedigrees in Queensland. Most often, pedigrees contain only the favourable records of some individual animals in the pedigree while most animals have no record. Purchase of this type of pedigree is bound to lead to disappointment and farmers are strongly advised to avoid selection by this method alone.



Plate 4.

The Average Production of a Line Bred Herd is a Better Guide to the Possible Value of Bulls and Heifers Purchased from that Herd than is the Individual Performance of One or Two Selected Cows in the Herd.

Animals with good type or production but with mediocre pedigrees will probably prove unsatisfactory as breeders. Such animals should certainly be at least partially progeny tested before being used extensively as breeders in the herd.

In the case where the animal has produced no offspring which can be inspected, the best indication of the type of animal it is likely to produce may be had by examining its ancestors for two, or perhaps at most three, generations back. If these ancestors are of uniformly high standard, it may be assumed that the beast's descendants will tend to be of a similar standard. If there is lack of uniformity in the quality of the near ancestors, the beast may give offspring of higher or lower quality than its own appearance would suggest. In considering the merit of near ancestors, it is wise to bear in mind the fact that these animals are selected individuals, and that frequently the information available concerning them is also selected in order to make them appear in as favourable a light as possible. It is, therefore, advisable to discount these records a little in estimating the breeding worth of the offspring.

The evaluation of pedigrees is at times exceedingly difficult. Most pedigrees as presented by breeders and breed societies in Queensland give no information concerning the breeding value of the animal from the production side. This failing is probably the fault of neither the breed society nor the breeder, but is due largely to the inadequate system of advanced register testing which was practised in Queensland until recently. With the introduction of an improved testing scheme for the advanced register, coupled with a big development in group herd recording, pedigrees will in future come to mean a great deal more to dairymen in this State than has been the case previously.

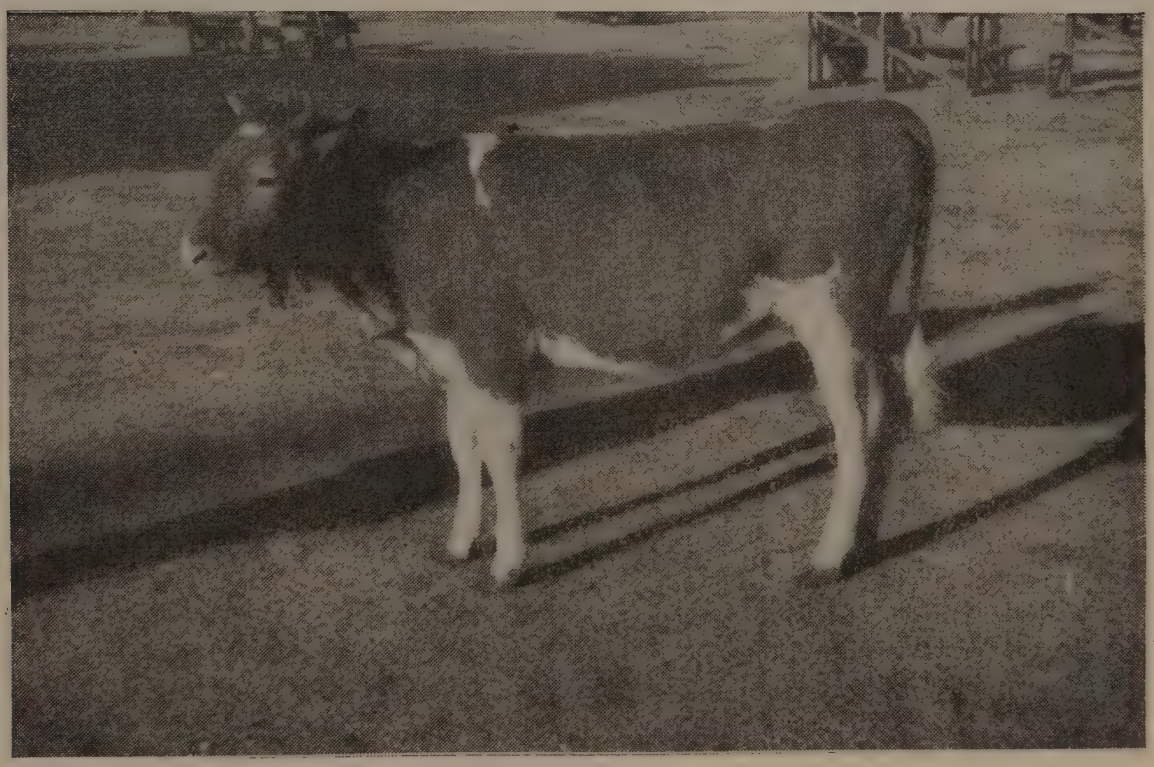


Plate 5.

A Heifer by a Proven Sire from a Herd of High Producing Cows is a Better Buy than a Heifer by an Unproven Sire from a Cow with an Individually High Production Record in an Unrecorded Herd.

To be useful a pedigree must be complete. A mere list of names with records of occasional high producers is unsatisfactory. All ancestors should have their records, high or low, appended to the pedigree, and all available information concerning the performance of collateral relatives should likewise be appended. Unless care is exercised it is easy to be misled by information on the good producers and lack of information concerning the poor producers.

The prospective purchaser should at all times ascertain the exact conditions under which production records appearing in the pedigree were made. The purchaser should find out whether the records were made off grass or as the result of heavy feeding with high quality feed. The number of times the cow has been milked each 24 hours also affects the records, as there is an appreciable lift in production when thrice-daily milking is practised. The effect of environment is of the utmost importance in assessing the possible breeding worth of an animal.

One of the common fallacies associated with writing and interpreting pedigrees is the undue stress often laid on some particular ancestor far back in the pedigree. Thus a cow "Rose" seven generations back may have been an outstanding animal, but "Rose 7th" will be little influenced by the gene composition of the original Rose, unless there has been considerable inbreeding.

For fuller utilisation of pedigree in dairy sire selection, the need is for more complete records of registered stock, and in this respect the breed societies have a responsibility to the industry. Commercial dairymen are entitled to records of production in respect of purebred cattle that they purchase. The stud breeder for his part should see to it that the breed society to which he belongs takes an active interest in ways and means of improving methods of recording performances of all purebred animals within the breed. It is an anomaly that animals supposedly bred only for the purpose of milk production should continue to be bred and registered by breed societies without an effort being made to check their individual ability as producers.

Selection of animals according to pedigree has advantages for certain characters and types of animals. As previously pointed out, when selection is made according to individual performance there is a tendency for the offspring to revert to herd average. When selection is made on pedigree this reversion effect will still be noticed, but provided the selected animal comes from a family which shows consistently high production, reversion towards the breed average is likely to be very much less than when selection is made purely on the basis of the dam's record. Thus in characters such as milk production which are not strongly inherited, pedigree can be an important aid to selection.

It is frequently necessary to select both heifers and bulls at an early age, before the heifer has had a chance to produce, or before the bull can be proven. The safest way to select such stock for production is on their pedigree, the selection being based on the assumption that the merit of the animal under consideration will be close to the average of the animals in the pedigree for two or three generations back.

It must at all times be kept in mind that the accuracy of pedigree selection is modified by the "sampling" nature of inheritance. The chances are that, on the average, the selected animal will produce as expected, but the gene composition may be more or less favourable than the average, in which case the beast will turn out to be better or worse

as the case may be than was anticipated from an examination of the pedigree. Using pedigree selection it is not possible to anticipate the production of the individual, but it is possible to predict the average production of a group of animals deriving from the same parents or families.

Selection by Progeny Test.

The use of progeny testing in order to find the most desirable breeding animals is not new. It has probably been used by progressive breeders, even if sometimes unconsciously, as long as animals have been domesticated, and it was employed extensively in its modern sense in England, particularly by Bakewell, when the modern British breeds of livestock were being standardised. This application of the progeny test, together with inbreeding, probably did more than anything else to place British breeds of livestock in the pre-eminent position which they have held for so long. It is only in comparatively recent times that animal breeders in other countries have equalled, and in some cases excelled British breeders. The success of the Western European breeders in this connection is founded on progeny testing even more firmly than were the earlier successes of the British breeders.

Progeny testing has been refined and extended considerably since the days of Bakewell, and is now a precision tool with which animal improvement can be affected. It is particularly important in herds of already high standing, where further progress is a matter of considerable difficulty.

Like phenotypic selection and pedigree selection, progeny testing has both advantages and disadvantages.

In such animals as dairy cattle a bull may be at least five years of age before a reasonable number of his daughters are available to give an indication of his ability as a sire. In many cases, therefore, the bull will be dead or gone elsewhere long before he is proven. The dairyman setting out to find a proven bull will need to keep many bulls on his property or to sell with the option of repurchase in three or four years' time. Few farmers can afford to keep half a dozen bulls. A bull sold to another herd is always in danger of contracting disease or becoming infertile. Bull proving, therefore, is not as simple as it may appear at first sight.

It is necessary to have enough *unselected* offspring from the bull to be reasonably certain that judgment is being made on a true cross section of the offspring as a whole. If daughters to be tested are specially selected, the value of progeny testing is greatly reduced. Even a mediocre bull will often sire some good daughters. The dams to which the bull is mated should for preference also be an average sample of the herd. The commercial dairyman is not looking for a few high producers, but rather for a high average herd production. Selection by progeny test is an example of *genotypic* selection, in which the breeder selects on the basis of the inherent ability of an animal to transmit desirable characters to the offspring quite apart from the animal's own merit as an individual.

Despite very real practical limitations, progeny testing is a most valuable aid to selection. It should, however, be used as an aid and not, as is sometimes suggested, as the sole means of selection.

Full use may be made of the progeny test by any dairyman who regularly records his herd, even if only as a check on his selection of a sire by phenotype and pedigree means. The production records of the first five or six daughters sired by the bull will give some indication of his value as a sire, and on the records of these daughters he may be classed as a very good bull, a very bad bull or a bull possibly deserving of further trial. When 10 daughters have been tested, a final decision can be made about a bull classified as worthy of further trial. If dairymen generally were to use the progeny test only to this extent, many average herds would have their production improved, and fewer good herds would be ruined by using a poor bull for a long period without becoming aware of his deficiencies as a sire.

One of the most difficult aspects of dairy herd management is to maintain high production in a herd. It is in high producing herds that the use of progeny testing can be of most value. In such herds reliance on phenotype and pedigree selection is likely to be disappointing because the herd is very much above breed average in production, and there is a constant tendency for all cattle to return to breed average. Only by the use of bulls proven as sires of high producing daughters, or sons of such bulls, can the farmer maintain his herd at the peak of production.



Plate 6.

If a Proven Bull is not Available then the Son of a Proven Bull may be the Wisest Selection for a Herd Sire.

There is a considerable amount of evidence to show that sons of bulls proven for production are themselves herd improvers, and for the average commercial dairyman, who is not in a position to pay the high price likely to be asked for the odd proven bull available, the son of a proven bull is a wise choice.

PUREBRED SIRES AND INCREASED PRODUCTION.

That part of production improvement which can be accomplished by selection and breeding in commercial herds is founded on the stud or pure-breeding industry. Progress can rarely be made towards the selection of higher producers in grade herds unless bulls of high production potential are available from the purebred herds.

Considerable stress has always been placed on the importance of the purebred bull in bringing about an overall improvement in the production of commercial dairy herds. Because of the flow of propaganda from Departmental extension workers and breed societies, the purebred bull is much sought after. This propaganda programme has proved so effective that there may be occasions when commercial breeders buy a bull simply because he is a purebred bull, and not because there is anything about him which would suggest that he is capable of siring above average quality daughters.

Breeders of purebred dairy stock have a responsibility to the industry in this respect. It has often happened that young breeders have met with a considerable setback when the purebred bull which they bought in the hope of improving their herd has proved incapable of doing the job for which he was purchased. Even when all possible care is taken, a percentage of purebred bulls will prove failures, and the expenditure of much effort in selection for qualities which have only questionable relationship to production and little or no effort in selection for production itself can only increase the percentage of these failures to the detriment of the breed and the industry.

The development of a good stud herd is often a lifetime's work. A constructive breeding programme cannot be developed in the short period of two or three cow generations.

The stud breeder must direct his efforts towards demonstrating the practical worth of his animals. Stress should be placed on records of performance for all registered stock. This is the only sound basis for the evaluation of animals, and insistence on this point can eliminate much of the guesswork from selection.

It is essential that studmasters develop a policy in line with unbiased scientific thought and free from old notions and prejudices. The stud breeder is working for the improvement of his chosen breed; the efficiency of his breeding policy will be most apparent in improved production of the grade herds to which he supplies bulls.

The introduction of a purebred bull into a grade herd should be accompanied by the knowledge that he has the potential to maintain or improve the average production of the cows in the herd. Where all cows in the purebred herd from which the bull derives are not recorded, it is difficult for the commercial dairyman who has a herd with known high production to be sure on the point.

Purebred breeders should justify their position as bull breeders by keeping reliable records and by maintaining the average production of their herd above that of the grade herds in their immediate neighbourhood.

APPENDIX A.

Type Score Card for Dairy Cattle.

It has been stressed in this article that undue attention should not be given to show points of conformation in evaluating a dairy cow, but a knowledge of the type to which show exhibitors are endeavouring to breed is desirable for all young breeders. For this reason a score card for a typical dairy cow irrespective of breed is reproduced herewith. Young breeders are warned not to regard all of the desirable features stressed here as being associated with high production.

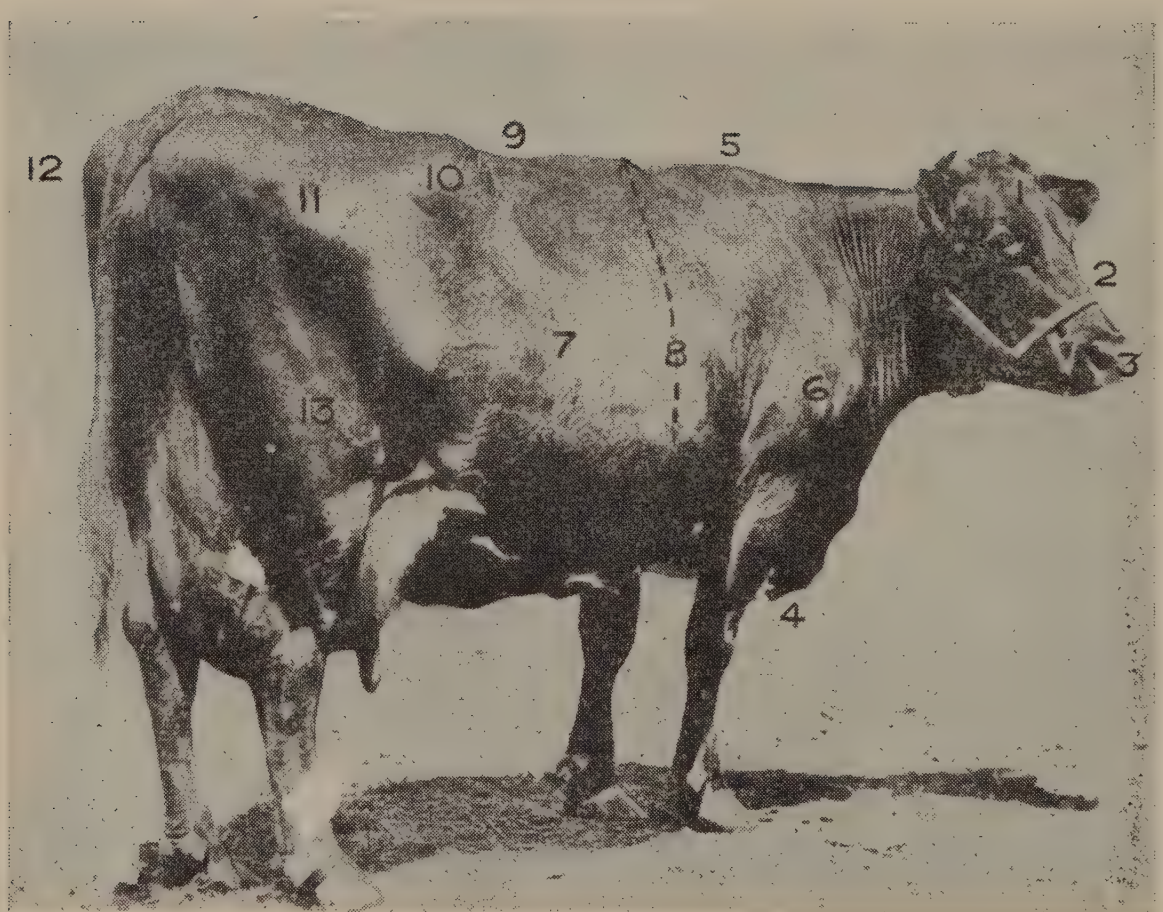


Plate 7.

Points of a Dairy Cow.—1, forehead; 2, face; 3, muzzle; 4, brisket; 5, withers; 6, shoulder; 7, barrel; 8, heart girth; 9, loin; 10, hip; 11, rump; 12, pinbone; 13, thigh.

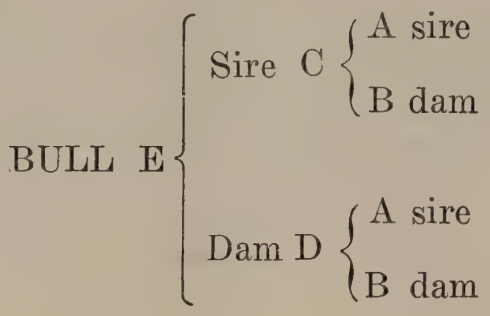
POINTS OF A TYPICAL DAIRY COW.

Scale of Points.		Maximum Points.
General Appearance.		
Constitutional Vigour: As shown by heart room, apparent health, strength, activity, and general appearance	5	19
Form: Wedge-shaped, as viewed from front, side and top (additional points given in detailed section)	3	
Quality: Hair fine and skin soft, medium thickness, loose, mellow, and unctuous with yellow secretion	6	
Temperament: Active and nervous (but not " wild "). Indicated by movement, eyes, and lean appearance	2	
Colour	3	
Head, Neck, and Throat.		
Forehead: Broad and full		8
Horns: Fine and of medium size		
Eyes: Large, bright and yet placid		
Face: Lean, medium length, straight or slightly dished		
Muzzle: Clean and strong mouth and nostril large		
Ears: Medium size, fine in texture, yellow pigment inside		
Neck: Rather long and thin, fine, clean throat and dewlap		
Forequarters.		
Chest: Broad and deep		3
Brisket: Lean and not fleshy		
Withers: Well defined, and not coarse at point of shoulders		
Shoulders: Light, sloping, not too fleshy and oblique		
Legs: Straight, rather short, and not too large or coarse		
Body.		
Backbone: Well defined, lean, open-jointed and level	3	21
Barrel or Body: Long and large, ribs broad, well arched, open and set wide at finish; a large strong body in proportion to size		
Heart Girth: Large and deep, abundant room for active heart and lungs	18	
Belly: Large, broad, and deep, with a large and strong navel		
Loin: Broad and strong		
Hindquarters.		
Hips: Wide apart, lean, and refined		16
Pelvic Arch: Prominent and strong	6	
Rump: Long and wide, with pin bones wide apart and well defined		
Tail: Long, fine with good switch and neatly set on	2	
Thighs: Long and lean, flat inside and out, no beefiness, thin arched flanks		
Legs: Rather short, wide apart and not coarse, placed squarely under the body	8	
Udder.		
Fore udder: Full, broad and extending well forward, not fle		31
Hind udder: Broad, full and attached high, not fleshy, plenty loose skin with a silky touch, without pronounced quartering	18	
Teats: Of good size and form, evenly placed and hanging perpendicularly, texture soft	5	
Milk Veins: Upon the udder and in front of it, prominent, large and tortuous, leading to open milk wells	5	
Escutcheon: Good of its kind	3	
		100

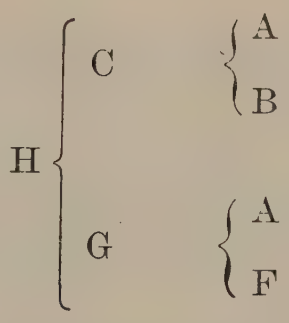
APPENDIX B.

Breeding Systems.

Inbreeding.—By inbreeding is meant the mating together of two closely related animals.



In this case the bull E would be inbred as he is the result of mating bull C to his full sister D, Similarly, mating father and daughter, or son and dam, would be considered inbreeding. The mating of even less closely related animals may still be considered inbreeding, as in the following case where H is the offspring of half-brother and half-sister:—



It has been aptly said that inbreeding is a negative method. By inbreeding, the breeder does not hope to gain anything new. By its use, he expects to purify the gene make-up of the animals with which he is working. In other words, he concentrates the genes for which he is selecting, and eliminates the undesirable genes with his culls, thus eventually building up a herd of relatively homozygous animals from a herd which was originally heterozygous.

Inbreeding is the only means by which the breeder can get uniformity in his herd, but a breeder should never begin inbreeding unless he is satisfied that the best animals in his herd are of sufficiently high merit, for by inbreeding he cannot produce animals better than the best he already has. Inbreeding concentrates the qualities of the animals, and there is no discrimination between the good and bad qualities, so the practice is fraught with danger and must necessarily be accompanied by a very heavy culling programme. Often, in fact, whole strains of animals must be culled.

Inbreeding, therefore, is something which should be avoided by the small man, and where practised by the large breeder, should always be undertaken in parallel lines with prearranged design for assessment of results and a heavy culling programme based on progeny testing.

Culling must go beyond the culling of individuals. Where a strain is found to contain defective animals, the strain should be abandoned and future breeders selected from those strains which have not shown defectives.

Line Breeding.—Line breeding is the term used by practical breeders to indicate a less intensive form of inbreeding, usually the mating of cousins or animals more remotely related. Breeders frequently so differentiate between the terms close breeding and inbreeding and line breeding, but they are terms which differ only in degree.

Outcrossing.—Outcrossing is the crossing of two unrelated strains, within the same breed which have no common ancestors closer than four generations back.

Inbreeding is the tool used to produce uniformity in the strain; outcrossing is the tool used to introduce variation.

For instance, a breeder may have produced an inbred strain which, because of an oversight in the early selection, has a low butterfat percentage. While he continues with that particular strain, no matter how he selects he will not be able to increase the butterfat percentage, for the genes responsible will be fixed and no amount of selection within the strain will alter that percentage. However, if he selects another strain of the same breed of cattle with a higher butterfat percentage, and makes an outcross with that strain, sufficient variation will be introduced into his original strain for further selection for higher butterfat content to be made.

Cross Breeding.—Cross breeding is going one step further along the line to variation than outcrossing, for cross breeding is the crossing of two distinct breeds. When cross breeding is undertaken intentionally, it is usually done in search of so-called "hybrid vigour".

Crosses made between two breeds usually give a very uniform type of first generation offspring, with strong constitutions and excellent production qualities. Why this should be is not so evident. However, it is suggested that certain genes are responsible for the good qualities in each breed of animal and that each breed may be lacking in some genes which the other possesses. When the two breeds are brought together, there is a blanketing effect, whereby genes lacking in one breed are covered by those in the other, with a resultant improvement in the qualities transmitted by both parents and the development of hybrid vigour in the offspring.

Unfortunately, however, the improvement ends with the first generation, and further crossing leads to a multiplicity of types, most of which prove inferior to the original parent breeds.

Hybrid Breeding.—Hybrid breeding is the term used when two distinct species of cattle are crossed, as, for example, when Indian or Brahman (Zebu) cattle are crossed with one of the British breeds of dairy cattle. Hybrids resulting from such a cross are fully fertile and will breed freely with either parent breed or amongst themselves.

Grading Up.—Grading up is the term used when purebred bulls are mated with crossbred or "mongrel" cows and subsequently with their offspring, generation after generation, until (after four or five generations) the original mongrel herd is raised to a status which approximates that of a purebred herd.

APPENDIX C.

An Informative Pedigree.

Stud Name : FAIRYDALE.

Name : Fairydale Mary's Prince.

Born : 20–11–50. *Tatoo :* 353.

Address : J. Smith, "Fairydale," *via* Ipswich.

Breed : Jersey. *Sex :* Male.

H.B. No. 56,331. *Colour :* Broken.

Sire : Fairydale Desire's Duke.

10 A.R. daughters
10 daughters over 300 lb., fat as Jnr. 2's
8 daughters over 400 lb., fat as Jnr. 3's
1st R.N.A. 1949 Bull, 4 years and over

Sire : Oaklea Grand Duke.

12 A.R. daughters
12 daughters over 270 lb., fat as Jnr. 2's
6 daughters over 420 lb., fat as Jnr. 3's
Champion R.N.A. 1946

Dam : Fairydale Ideal's Mary.

8,000 lb. milk, 5·5% test, 440 lb. B. fat as a Jnr. 2
10,000 lb. milk, 5·2% test, 520 lb. B. fat as a Jnr. 3
10,755 lb. milk, 5·3% test, 570 lb. B. fat as a Jnr. 4
11,765 lb. milk, 5·1% test, 600 lb. B. fat mature
2nd R.N.A. 1950 Cow, 4 and under 5 yrs. dry class
1st R.N.A. 1949 Cow, 3 and under 4 yrs. in milk

Dam : Craigview Desire.

10,577 lb. milk, 5·2% test, 550 lb. B. fat Jnr. 2
12,745 lb. milk, 5·1% test, 650 lb. B. fat Jnr. 3
13,396 lb. milk, 5·3% test, 710 lb. B. fat Jnr. 4
14,327 lb. milk, 5·2% test, 745 lb. B. fat mature

Sire : Fairydale Ideal.

5 A.R. daughters
3 daughters over 270 lb., fat as Jnr. 2's
2 daughters failed as Jnr. 2's
1 daughter over 400 lb. fat as Jnr. 3's
1st R.N.A. 1947 Sire and his progeny group.

Dam : Daydawn Prince's Doris.

8,727 lb. milk, 5·5% test, 480 lb. B. fat as Jnr. 2
10,865 lb. milk, 5·2% test, 565 lb. B. fat as Jnr. 3
11,509 lb. milk, 5·3% test, 610 lb. B. fat as Jnr. 4
12,500 lb. milk, 5·2% test, 650 lb B. fat mature

An Uninformative Pedigree.

Stud Name : FAIRYDALE.
Name : Fairydale Mary's Prince.
Born : 20–11–50. *Tattoo :* 353.

Address : J. Smith," Fairydale," *via* Ipswich.
Breed : Jersey. *Sex :* Male.
H.B. No. 56,332. *Colour :* Broken.

Sire : Fairydale Desire's Duke 1st R.N.A. 1949	*Sire :* Oaklea Grand Duke Champion R.N.A. 1946	*Sire :* Karama Pioneer	
		Dam : Oaklea Madiera	
	Dam : Craigview Desire, 745 lb. B. fat mature	*Sire :* Fancy Prince 2nd	
		Dam : Craigview Bess	
Dam : Fairydale Ideal's Mary 2nd R.N.A. 1950 1st R.N.A. 1949 720 lb. B. fat	*Sire :* Fairydale Ideal	*Sire :* Karama Golden Duke	
		Dam : Fairydale Hazel	
	Dam : Daydawn Prince's Doris	*Sire :* Daydawn Prince	
		Dam : Daydawn Rosella IV.	

A Trap Gate for Cattle.

K. F. HOWARD, Adviser, Cattle Husbandry Branch.

TRAPPING of cattle has been practised in Queensland in the past and is still used on some beef cattle properties. Trap gates have many limitations, but when used intelligently under specific conditions they can prove a labour-saving device.

As the principle of the gate is to trap cattle when watering, it is essential that all fences be stock-proof and that alternative sources of water be fenced off and preferably fitted with trap gates.

The value of an effectively constructed trap is highest in country that is difficult to muster, and trap gates should prove particularly useful in brigalow country.

When using the trap for cows and calves, the presence of dingoes should be borne in mind, as some calves will no doubt find themselves outside the trap and so separated from their mothers.

Trap gates are still used in parts of southern Texas (U.S.A.) and are considered to be a great asset in country carrying heavy mesquite scrub. The following description is of the type of trap that has proved its worth on some of the larger cattle properties in Texas.

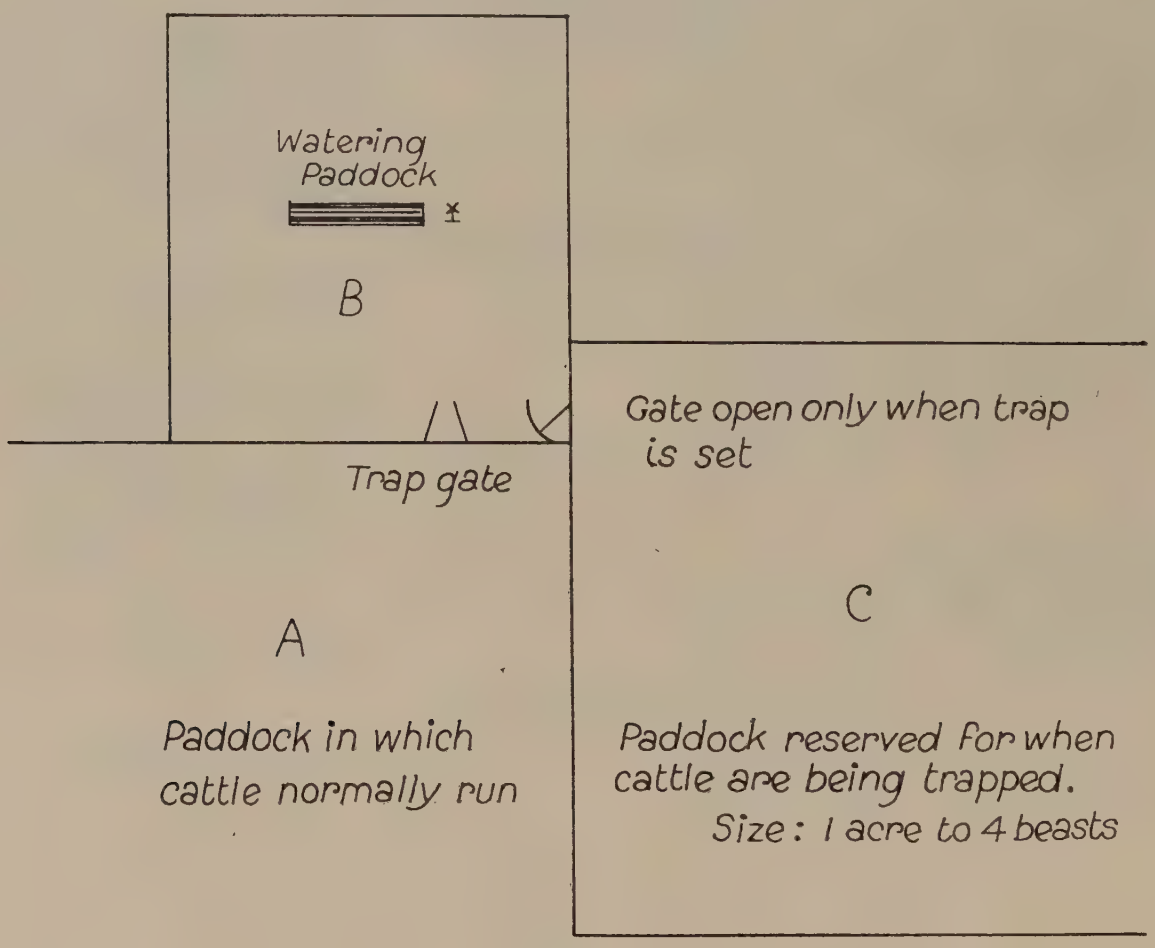


Plate 1.

Diagram Showing Position of Trap Gate in Relation to Paddocks.

Principles of Operation.

These are best explained by referring to Plate 1. Normally, cattle pass from paddock A to paddock B through the opened trap gate. Paddock C is normally shut off, but when "setting" the trap gate it is opened to paddock B, so that the cattle, though unable to return to their paddock, can obtain feed. The size of paddock C varies according to the number of cattle being run in paddock A; a quarter of an acre per beast is a good guide.

The time elapsing between the setting of the gate and the trapping of all the cattle varies according to the wildness and education of the herd as well as the weather and the moisture content of the pasture.



Plate 2.

Trap Gate in the Set Position.

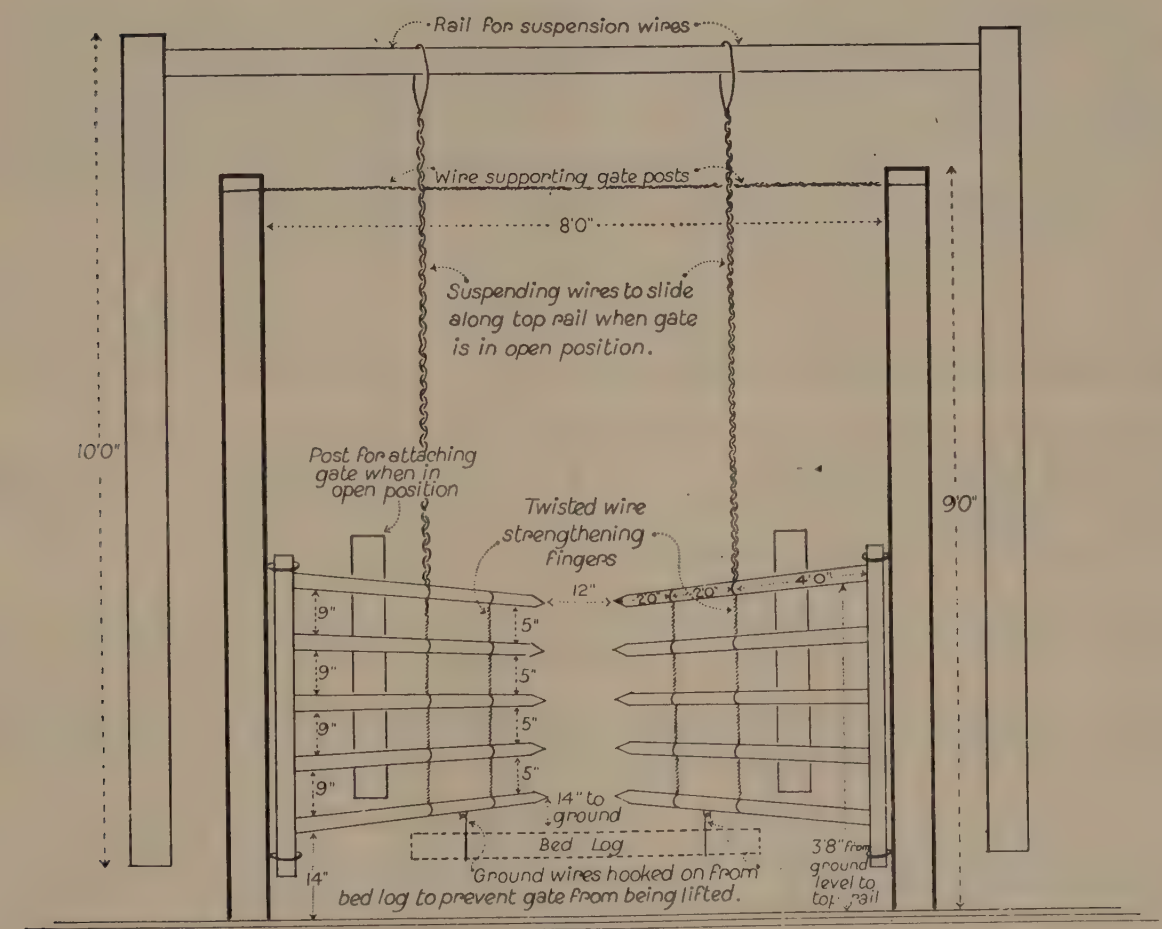


Plate 3.

Details of Construction and Suspension of Trap Gate.

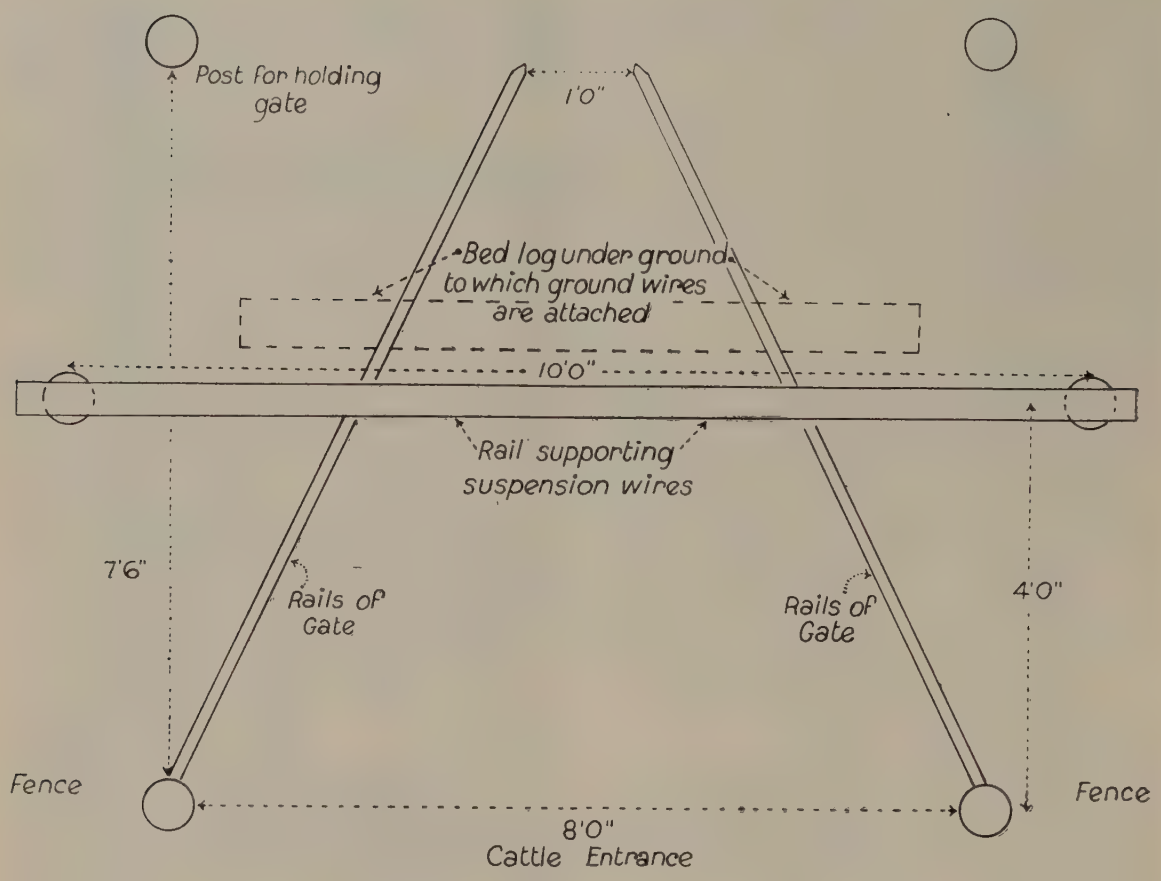


Plate 4.

Diagram of Trap Gate Viewed from Above.

Construction.

Particulars of construction are given in Plates 2-4. An important factor in construction is to have the top rail of the gate low enough for the average beast to get its head over—that is, it should be not higher than 4 ft. from the ground. The gate rails, or "fingers," are joined to the uprights by bolting or twitching, and each gate is hinged to its gate post. The fingers are made more rigid by tying with twisted wire at 4 ft. and 2 ft. from the free ends of the fingers.

The gates are suspended from an overhead log by means of wires, and these wires, together with those from a bed log to the bottom rails, hold the gates in position when it is set.

There should be about 12 in. between the ends of the gates when they are in the set position. The wires holding the gates in the set position should have just enough tension to spring the gates back into position after a beast has pushed its way through.

The suspending wires are looped over the overhead rail so that they can be slid along the rail when the gates are in the open position.

The bottom rail of the gate is about 14 in. off the ground and the rails at the free ends are spaced about 7 in. apart (centre to centre).

The ends of the fingers are slightly sharpened so as to discourage cattle from attempting to return through the set gate. The fingers should be constructed of strong bush timber with a diameter of 2-2½ in.



The Influence of Feeding Practice on Baconer Carcase Quality.

K. J. HUTCHINSON (formerly Assistant Husbandry Officer, Pig Branch).

THE undesirability of marketing overfat pigs is being constantly publicised. This is necessary because consumer resistance to over-finished bacon and ham is a constant problem of the bacon factory. Public preference for the product which contains a relatively high proportion of lean meat is possibly most marked in subtropical and tropical areas such as Queensland, where fats play a far less important role in the human diet and are regarded by many as distasteful.

Under such influences, quality improvement of baconer carcases becomes largely a question of reducing the incidence of "overfatness."

There are several general approaches to the solution of this problem. Firstly, the farmer should exercise a more thorough selection of his marketable stock and dispose of them before they become "overfat". However, in many cases he is faced with the problem of an inherited "too early" maturity in his growing stock, and if he wishes to carry his pigs on to bacon weight, in most cases they will be "overfat" when marketed. A long-range plan to correct this should be to replace or intensify selection for later maturity in the breeding herd. At the same time, some immediate improvement may be effected by altering the feeding practices.

FEEDING PRACTICES CAN INFLUENCE CARCASE QUALITY.

It is universally accepted that in the later stages of an animal's growth fat develops at a faster rate than either bone or muscle. Quality improvement of pig carcases through feeding practice has been largely based on restricting growth during this period. For bacon pigs this restriction can be practised between 100 lb. and 200 lb. liveweight.

Growth restriction in the "finishing off" stage is of course brought about by reducing feed intake. There are two ways by which this can be done. Firstly, the actual gross amount of ration feed can be reduced. The success of this practice in bringing about an improvement in carcase quality has been shown by many overseas trials. For example, in Great Britain experiments with Large White pigs showed that by reducing the feed intake by one-quarter in the 65-200 lb. liveweight stage, a marked improvement in grade resulted. Some 66% of the pigs receiving restricted rations achieved bonus grade, compared with only 18% in the group which received a full ration allowance.

The second way is in effect a reduction of the net feed intake and depends upon lowering the overall digestibility of the ration by adding a relatively indigestible component. Feeding-stuffs which are relatively indigestible for pigs, largely because of their crude fibre content, include wheat bran, oats, lucerne chaff, lucerne meal, chaffed peanut hay and brewers' grains.

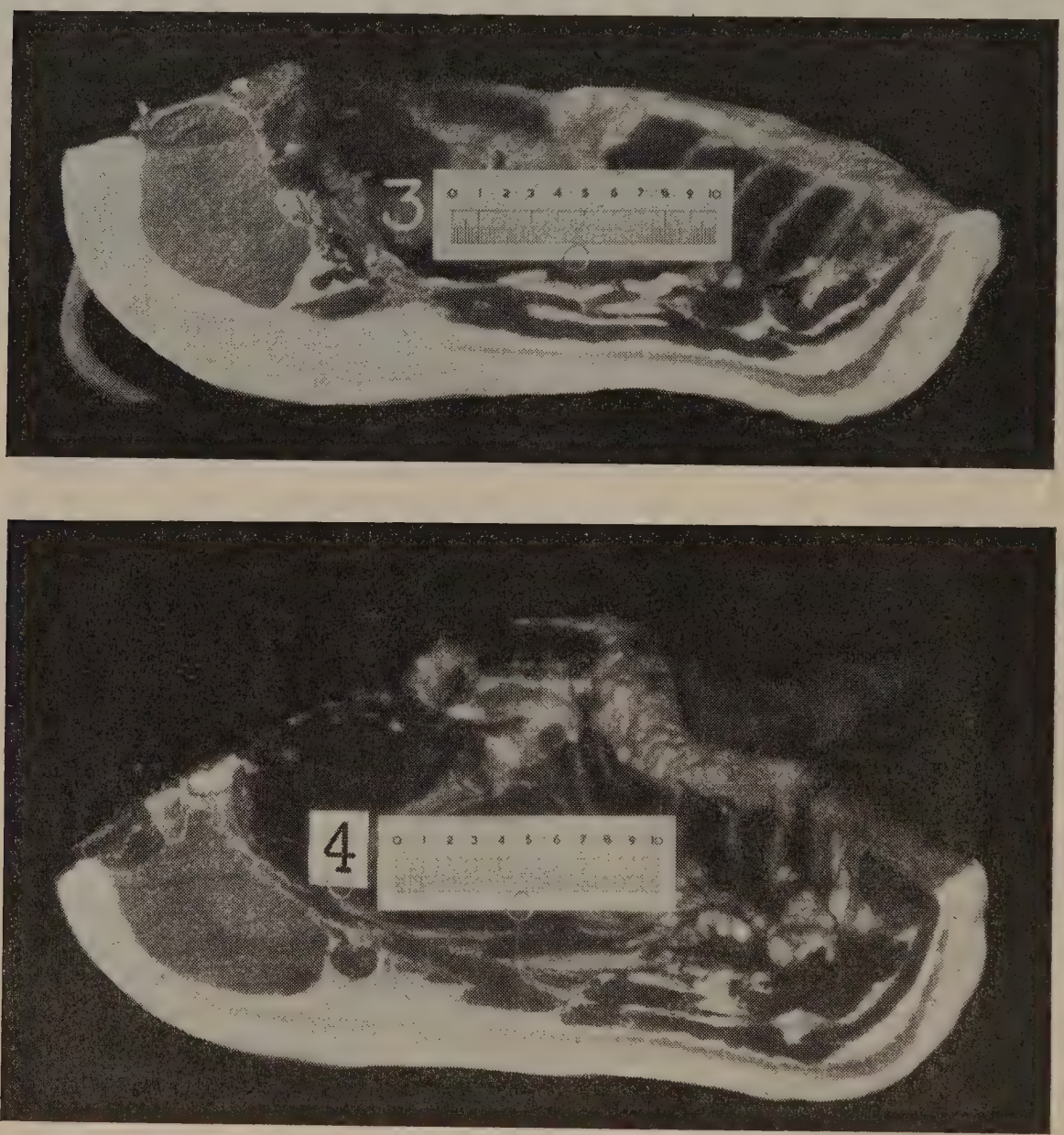


Plate 1.

Backfat Thickness Has Been Reduced by Feeding Lucerne Chaff in the "Finishing Off" Stage. Pig No. 4 received lucerne chaff as a substitute in the ration. Pig No. 3, a carefully selected litter brother, did not.

There are several advantages attached to the method which causes a feed intake restriction by indirect means. They include the following:—

(1) Self-feeding methods can still be used provided the mixture will "run" satisfactorily and the indigestible component is sufficiently palatable to discourage selective feeding.

(2) Because his pigs can feed to appetite, the farmer does not have to worry about the problem of determining how much should be fed to obtain effective restriction.

QUEENSLAND FEEDING TRIALS TO IMPROVE CARCASE QUALITY.

The method by which a reduction in the net feed intake is effected has been investigated by the Department of Agriculture and Stock. Lucerne chaff, because of its availability, was chosen as the relatively indigestible component of the "finishing off" ration.

Trial 1.

This trial was carried out at H.M. State Farm, Palen Creek. Two groups of Berkshire pigs were employed. Group A as control was fed a meatmeal-grain ration with mineral and vitamin supplements. Group B was fed a ration similar to A but with the following levels of lucerne chaff substituted pound for pound for grain:—

Liveweight. lb.	Percentage of Grain Progressively Substituted by Lucerne Chaff.
100–135	5
135–165	10
165–200	15

In contrast to trial 2 (see later), which was carried out under field conditions, the fullest possible experimental control was exercised. Ten pairs of pigs were selected for similarity in conformation, sex, litter and initial weight at approximately 70 lb. liveweight. Each pair was housed in an experimental pen and fed a ration of grain and meatmeal until 100 lb. liveweight. At this weight one of each pair was allotted at random to each group. Experimental treatment was then commenced and carried through until individuals reached approximately 200 lb., when they were slaughtered, appraised and photographed.

Pairs were housed together but fed individually twice daily. Consumption was accurately recorded and offerings so arranged that the total feed consumptions of the individuals in each pair were equal. In this way differences in gross feed intake, which would affect growth rate, were eliminated. As confirmed by palatability observations in trial 2, there was no difficulty in maintaining consumption in relation to normal allowances. It was observed, however, that pigs receiving the lucerne chaff substituted ration fed longer than the control animals.

Plate 2 shows the average liveweight of the two groups throughout the trial and Table 1 presents the more important results.

TABLE 1.

SUMMARY OF DATA FROM TRIAL 1.

—	Control Ration. (Group A)	Substituted Ration. (Group B)
*(1) Growth rate (lb. per week)	10·03	8·84
*(2) Thickness of backfat at loin (mms.)	23·2	21·2
*(3) Area of fat in sq. in. (in loin section)	116·7	103·2
*(4) Ratio of lean to fat	0·58	0·68
Average dressed weight (lb.) for all pigs appraised ..	152	

Technical Notes.—

(1) Difference significant at 0·1% level.

(2) Difference approached significance at 5% level.

(3) Difference significant at 5% level. Area of fat was obtained by measuring total area and area of lean on full-scale photographs with a planimeter, and subtracting the latter from the former.

(4) Difference significant at 5% level.

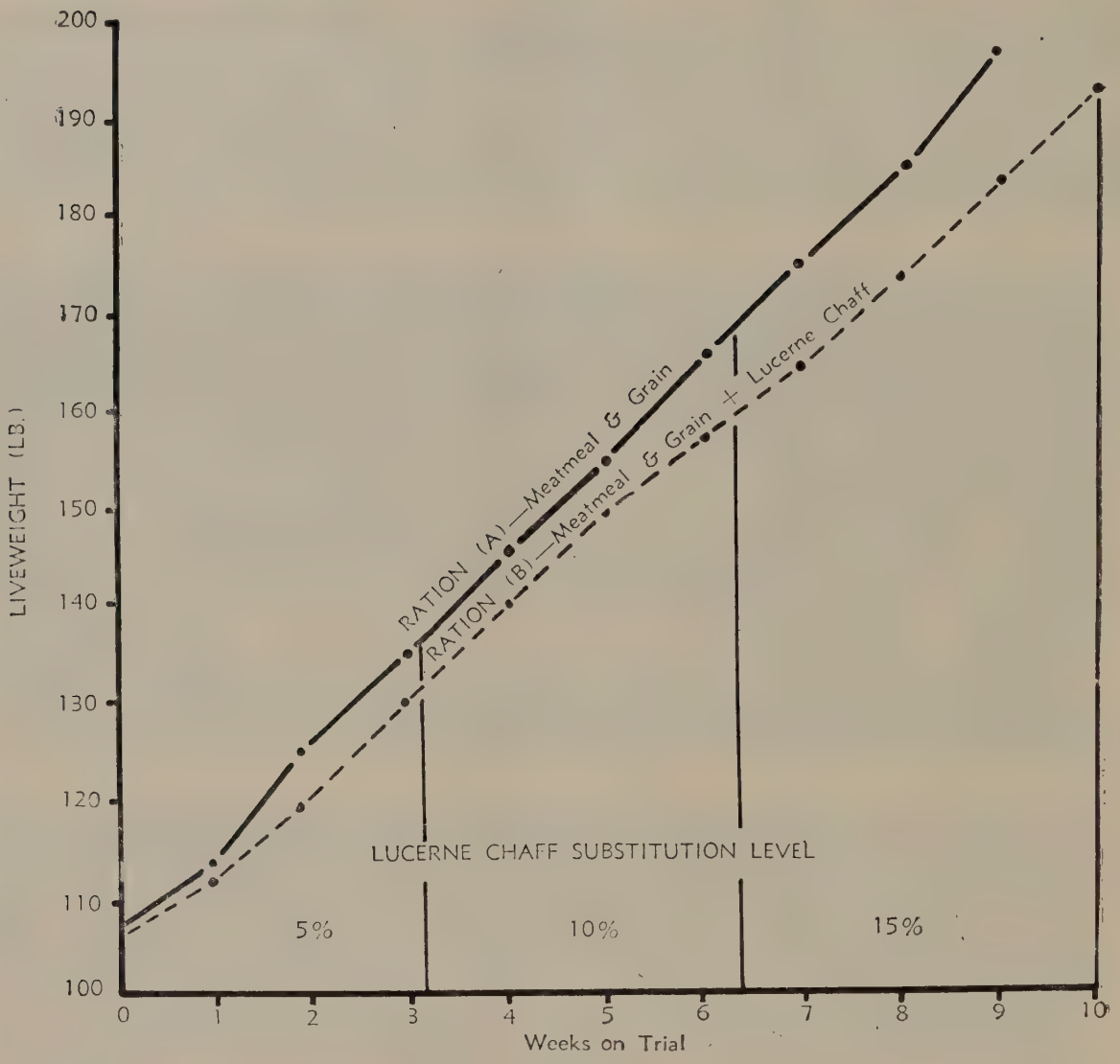


Plate 2.

Graph Showing How Growth Has Been Slowed Down in the Fat Developing Stage by Substituting Lucerne Chaff for Portions of the Grain Component of the Ration.

The effect of including lucerne chaff at the stated levels in the "finishing off" ration can be seen from inspecting Table 1. Growth rate has been slowed down in the fat developing stage by approximately 12%. At the same time there has been a consequent reduction in the amount of fat produced in the carcase, as shown by the appraisal figures, remembering that both groups were slaughtered at comparable weights. In other words, by this feeding practice, maturity has been delayed and hence the danger of overfatness has been reduced.

Trial 2.

This further trial, under field conditions, was carried out at Kairi Regional Experiment Station, on the Atherton Tableland. Because the farmer must necessarily feed a group of animals of various weights, it is not possible for him to maintain a feeding programme for each individual pig. This field trial was necessary then to demonstrate that the detailed results obtained in trial 1 would be effective in improving carcase quality under field conditions.

Twenty Tamworth pigs of various weights and mixed sexes were available from a number of different litters. However, since the value of this trial was one of field comparison, this variability coupled with the practice of group feeding to appetite was similar to practical farm feed-lot conditions.

Two groups each of 10 pigs of an average liveweight of approximately 100 lb. were formed, one being kept as a check and fed a meatmeal-grain mixture and the other receiving lucerne chaff substituted for grain as in trial 1. The pigs were slaughtered upon reaching 200 lb. liveweight, and the carcases graded according to the Northern Pig Marketing Board's standards and appraised by the Hammond method.

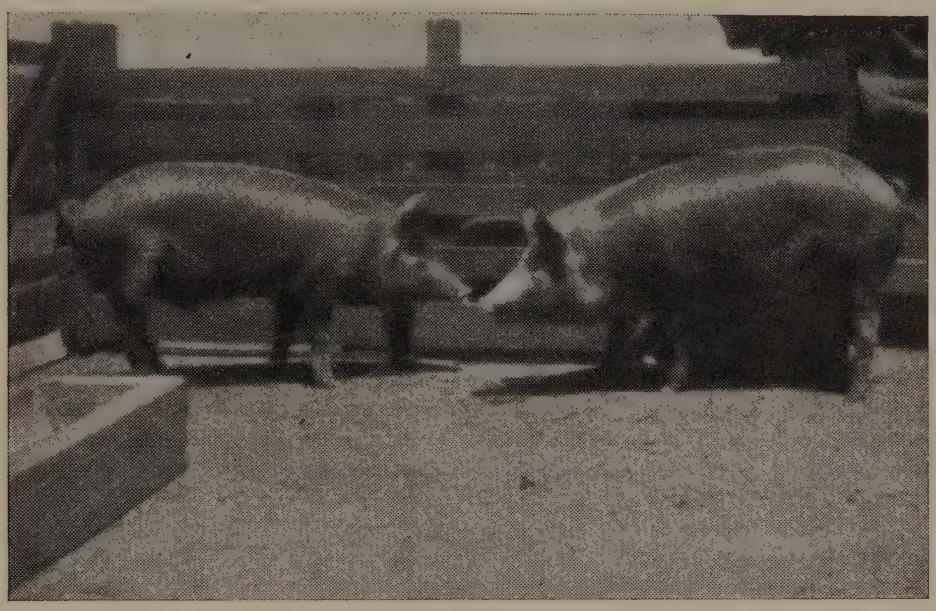


Plate 3.

The Effect of the Ration on Fat Development Can be Seen by Comparing These Two Pigs. The one on the left received lucerne chaff, while the other was fed on meatmeal-grain mixture alone.

Results again showed a growth rate restriction (10%) in the lucerne chaff group (Plate 3), which was accompanied by a marked improvement in grade (N.P.M.B.) and restriction of fat development (decrease 15% in loin backfat thickness).

THE ECONOMICS OF SUBSTITUTION.

In those areas where marketing systems are such that carcase grade does not affect payment, the economics of this feeding practice can be based mainly on the comparative prices of grain and lucerne chaff or substitute, provided that such things as the additional ration consumption brought about by the longer growing period are taken into account. Another minor factor is the additional labour cost to the farmer for having the pigs on his farm for this additional 10-12 days due to slower growth.

Considering lucerne chaff substitution at the 5-15% levels mentioned, the growth and ration consumption figures for trial 2 can be used as a practical example to illustrate the economics of the practice. Taking all factors into account, it was estimated that for group B, as compared with A, the grain saving due to lucerne chaff substitution was 233 lb., while at the same time the amount of lucerne chaff used was 396 lb.

From these two figures, a relationship can be drawn up showing the critical price of lucerne chaff beyond which substitution is uneconomical (Plate 4).

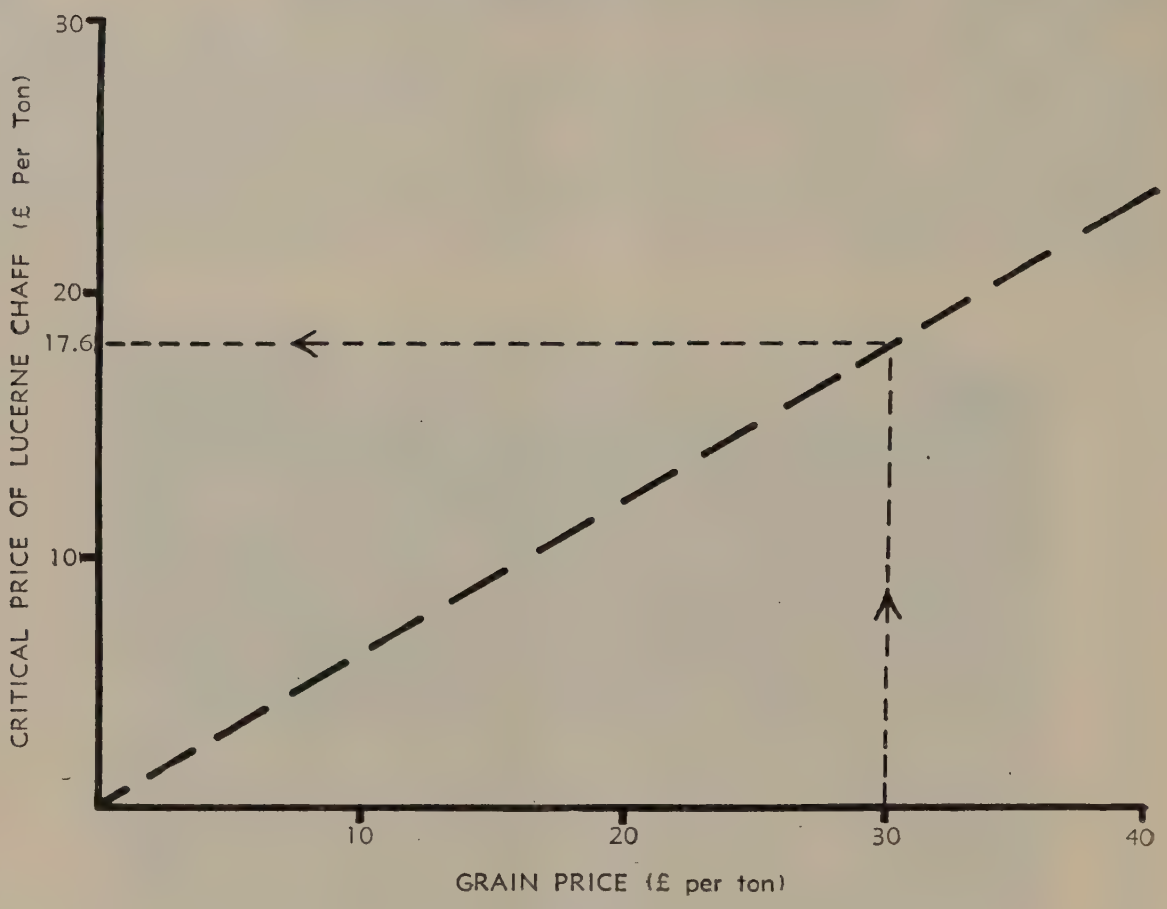


Plate 4.

Graph Showing the Economics of Substituting Lucerne Chaff for Grain Under Conditions Where There is no Premium for Quality. The dotted lines indicate how the graph is read. They show that if grain is £30 per ton, lucerne chaff cannot be substituted economically unless it costs £17.6 or less per ton.

Reading from the graph, if grain was purchasable at £30 per ton then it would be uneconomical to substitute lucerne chaff at the recommended levels if its purchase cost was more than £17·6 per ton.

There are several other points, however, which are worthy of note:—

(1) If grading was uniformly introduced, the practice would become increasingly economical.

(2) A similar improvement in grade can be expected by using feeding-stuffs other than lucerne chaff as the relatively indigestible component. These feeding-stuffs (oats, wheaten bran, chaffed peanut hay, etc.) have been mentioned previously and often may be obtained at a relatively lower cost.

(3) Even though the feeding practice may prove uneconomical to some degree, the quality improvement which results is in the best interests of the pig industry.

SUMMARY.

Feeding practice can play an important part in improving pig carcase quality. The feeding principle which brings about this improvement is a restriction of growth rate in the "finishing off" stage (100-200 lb. liveweight), where emphasis is laid on fat development. A practical method of achieving this is to substitute lucerne chaff for 5-15% of the grain in the ration at this period. Alternatives to lucerne chaff have been suggested.

Insofar as maturity is delayed and the danger of overfatness decreased, this method has been shown both by detailed experiment and by practical trial to improve carcase quality. When the value of grain saved is measured against the cost of the chaff substituted, the method is often economical even in the absence of a premium for quality.

ACKNOWLEDGMENT.

The enthusiastic co-operation of the staff of H.M. State Farm, Palen Creek, was a major contribution towards the success of trial 1.

Suitable Feeds for Pigs.

F. BOSTOCK, Officer in Charge, Pig Branch.

Maize.

Of all cereals, maize is the richest, or one of the richest, in carbohydrates and fat. Maize when fed alone does not supply an efficient ration, especially for growing pigs; and when being hogged down, or fed either on the cob or shelled, it should be supplemented with some protein-rich food.

Pigs fatten well on maize; but, as it produces a softer bacon than that from pigs fed on most other grains, it should not be fed to excess in the later stages of the preparation of baconers.

Sorghum.

Grain sorghum seed has a fattening value equivalent to 80 to 85 per cent. of that of maize; when fed alone it is an insufficient ration, and should therefore be supplemented with a protein-rich feed. Because of the hardness and size of the grain, grinding may be necessary, especially for young pigs. Outstanding qualities of these grains are their drought-resistance and sureness of cropping. Grain sorghums will fatten pigs, but unless properly balanced with protein supplements are inclined to produce bacon of inferior quality.

Barley.

Of all grains, barley is recognised as the best for fattening pigs. It produces pork and bacon of the finest quality, and, particularly, the fat produced is hard, white, and free from greasiness. Barley may be fed alone or with other grains.

Wheat.

Wheat may be fed alone or with other grains. It is an excellent feed for pigs, yielding firm flesh and a satisfactory fat, and possessing a nutritive value equal to barley, while from a protein point of view it is superior to barley. One disadvantage is that if finely ground it is inclined to become doughy when moistened, and for this reason it should only be cracked.

Oats.

Oats are not ordinarily used as pig food because of the large percentage of husk; also, when fed to young pigs scouring sometimes develops. Oats produce a good quality pork or bacon, but should be

finely ground if used for young pigs and coarsely ground for porkers, baconers and brood sows. This grain is useful for increasing the fibre or bulk in rations fed to baconers during the closing stages of the finishing period.

Peas.

Peas are rich in protein and are therefore useful in balancing such grains as have a high carbohydrate content. Fed alone, they produce a very hard, lean flesh, and young pigs do not thrive on them. Good results are obtained when peas are mixed with other grains, but they should not constitute more than 25 to 30 per cent. of the ration.

Millet.

If fed alone, millet will produce pork or bacon of inferior quality and inclined to be soft. For best results, millet should be mixed with other grains and should never exceed more than 30 to 35 per cent. of the ration.

Beans.

Beans also produce pork or bacon of inferior quality when fed alone, but can be profitably used with other grains, although they should not form more than 10 per cent. of the ration. Beans are not very palatable to pigs of any age. For best results they should be cooked or steamed, when up to 30 per cent. may be used.

Canary Seed.

An analysis of this grain indicates that the fat and protein contents are greater than for most other grains. However, the additional protein is not so great that it would materially reduce the protein supplements necessary to balance the ration.

With a high fat content, excessive feeding of canary seed would tend to produce a soft fat and for this reason it is recommended that it constitutes not more than 50 per cent. of the grain ration.

Rice.

Rice, if fed in excessive quantity, will produce flesh inclined to be soft. Because of the large percentage of husk, rice should not exceed 25 to 30 per cent. of any ration, except for light baconers to baconers, when it may form 50-55 per cent. of the grain ration.

Lentils.

An average analysis for lentils is crude protein 24.42 per cent., fat 0.58 per cent., carbohydrates 56.07 per cent., fibre 2.96 per cent. This suggests that lentils if fed excessively to pigs would produce a hard, lean flesh; therefore it is recommended that they constitute not more than 30 per cent. of the ration fed.

Arrowroot.

Arrowroot is a useful crop, as it is heavy yielding and hardy, and will stand in the field for long periods before it need be harvested. Although most of the nutriment is in the bulbs, pigs will eat the tops, which are usually succulent. Arrowroot may be fed raw or boiled, or the pigs may be allowed to harvest the crop themselves. This feed is a carbonaceous roughage and should be fed in combination with more concentrated and protein-rich foods.

Flour.

Flour may be used to replace up to 30 per cent. of the grain ration, but would have to be fed in conjunction with either milk by-products or meatmeal. If fed as suggested no trouble should be experienced with the pigs, but excessive amounts may lead to digestive disorders.

Potatoes.

Potatoes consist of about 75 per cent. water and 25 per cent. dry matter, which for the most part is composed of starch. In view of the large quantity of water, 4 lb. of potatoes are generally accepted as being equal to 1 lb. of maize or wheat. This raises the question of bulk. While potatoes may be fed to all classes of pigs, best results will be obtained when pigs are 16 to 18 weeks old, at which stage the digestive tract will have grown sufficiently to cope with the necessary bulk, and one-third of the grain ration may be replaced by potatoes. As pigs become older the proportion may be increased. Thus, by the time pigs are about 23 weeks old, two-thirds to three-quarters of the ration could be replaced, but it would not be advisable to go beyond this point.

Usually potatoes are too valuable to be used as pig feed. When they are available they should be boiled.

Sweet Potatoes.

Sweet potatoes are a bulky carbonaceous food which may be used to replace portion of the grain ration; about 4 lb. of sweet potatoes are considered equal to 1 lb. of grain. Pigs of all ages relish sweet potatoes, and they may be dug and fed in the yards, or pigs may be turned on to the crop and allowed to do the harvesting themselves. The vines make good green feed but there have been cases of poisoning; this risk, however, is very slight when compared with the large number of pigs which are fed on this crop. When pigs are fed on sweet potatoes, protein-rich foods such as separated milk or meatmeal should be included in the ration.

Cassava.

The root of cassava has a similar analysis to sweet potatoes. However, care must be taken unless the variety intended for feeding is known to be safe, because several varieties contain a prussic-acid yielding glucoside. Overseas feeding tests have shown that when cassava constitutes one-half of the ration severe scours result, but if only forming one-third of the ration good results are obtained.

Cassava has a value as a "stand-over" or reserve crop.

Mangolds.

These are a bulky carbonaceous food containing approximately 85 per cent. of water. They may be fed to all classes of pigs, best results being secured when pigs are 16 to 18 weeks of age, at which time up to one-third of the grain ration may be replaced by mangolds.

While there have been no reported cases of loss when feeding mangolds fresh, it is a good practice to store or allow to wilt for one or two days in a cool place before feeding. Reports have been received of poisoning when mangolds have been cooked.

Beetroot.

An average analysis for beetroot is crude protein 0.9 per cent., carbohydrates 9.1 per cent., fat 0.1 per cent., indicating that this crop can only be considered as a poor food for pigs and regarded as suitable only to supplement grazing or green food.

Tomatoes.

Tomatoes contain approximately 1 per cent. protein and 5 per cent. carbonates. They provide copper and their vitamin A content is good. However, the water content is high and they are therefore a bulky food. They are palatable to pigs and are best fed raw.

Tomatoes may be fed in combination with grain, milk or meatmeal and green feed. Should large quantities be available, 8-9 lb. may be used to replace 1 lb. of the grain ration.

Pumpkins.

Pumpkins contain over 80 per cent. of water and are therefore a bulky food, but they are palatable to pigs. They are best fed raw.

The seeds of pumpkins contain a fair amount of oil and protein and also act as a mild vermifuge. For these reasons they should not be wasted, but they should be fed with caution, as digestive troubles sometimes occur when excessive amounts of seeds are fed without the flesh of the pumpkin.

Pumpkins can be ready for feeding in good seasons from December onwards, and if stored in a dry, cool place and picked over frequently to remove the rotting ones the pumpkin supply may be kept up till the following summer.

Pigs relish pumpkins and the crop fits into the cropping system very well. Pumpkins are useful when fed in combination with grain, milk and lucerne. Cases of yellow colouration in the flesh of pigs fed heavily on pumpkins have been reported; therefore, care should be taken not to overdo pumpkin feeding with porkers or baconers.

Melons.

Melons are sometimes used as pig food, but contain approximately 95 per cent. of water. They are therefore not so nutritious as pumpkins.

Peanuts.

Peanuts may be fed to pigs of all ages, but because of their very high oil content (about 36 per cent.) will produce soft or oily bacon, and therefore should be eliminated from the ration at least six weeks before the pigs are ready for market.

Soybeans.

Soybeans also are an excellent food for young pigs, but they should be used in the same way as peanuts. The high oil content of the soybean (about 17 per cent.) will produce soft pork or bacon if care is not exercised.

Molasses.

Molasses contains approximately 57 per cent. of carbohydrates in the form of sugar, and is therefore a heat and energy producing food. It has a laxative effect on pigs, and is useful in dry seasons when green feed is not available or in short supply. Molasses should be fed in only small quantities, as careless feeding may cause severe diarrhoea.

Sugar-cane and Cow Cane.

These feeds contain large amounts of fibre not digested by pigs, and are of low food value, but during dry periods or when green feed is not available they may serve a useful purpose. Plenty of cane should always be fed, otherwise constipation may result from pigs feeding on the fibre.

Pollard.

Pollard is a valuable addition to grain foods, helping very considerably in balancing the ration, and its fineness makes it very suitable for young pigs. When fed alone, it has a tendency to produce soft flesh. The best results are obtained when it is used as a supplement to grain foods.

Bran.

Bran, when fed wet, has a laxative action, so is useful in preventing constipation in sows. It is usually given just before or after farrowing. It is not recommended as a fattening food.

Meatmeal.

Meatmeal, a protein-rich food, is a meatworks by-product. It is very valuable in balancing grain rations when milk or milk by-products are unavailable.

Blood Meal.

Blood meal is a protein concentrate containing 60–75 per cent. protein. Its palatability varies, but if mixed with other supplements it gives good results.

Fish Meal.

As a protein supplement, fish meal is equal to meatmeal, but if fed in excessive quantities may give a fishy flavour to the carcase.

Calf Meat.

In 100 lb. of calf meat there would be approximately 19 lb. of protein and 4 lb. of fat available as food. Boiled calf meat could be used successfully as a supplement to balance the grain ration and in this respect 100 lb. of meat when cooked is approximately $\frac{1}{3}$ the value of 100 lb. of 55 per cent. meat meal.

Linseed Meal.

Linseed meal should form only 6 per cent of a ration. It is a protein-rich food, has a fairly high oil content and exerts a laxative action.

Cottonseed Meal.

Cottonseed meal, a by-product, is a protein supplement. Its use has been limited because some cases of poisoning have been reported from feeding in too large a proportion or over lengthy periods. Recent experiments, however, have indicated that up to half the protein supplement of a ration may consist of cottonseed meal.

Cocoa Meal.

Cocoa meal cannot be recommended as a food for pigs, and has been known to cause abortion in sows.

Peanut Meal.

Peanut meal is a source of protein supply which gives good results, but it is preferably mixed with equal parts of meatmeal, the mixture being fed at the same rate as recommended for meatmeal. Peanut meal should not be fed in excess, because the bacon produced may be soft and have an unsatisfactory flavour.

Candlenut.

Refined oil from the candlenut has been used as a substitute for linseed oil, but as in the case of raw oil it causes severe scouring when included in the ration fed to pigs. The residue after extraction is known to contain poison and when fed to brood sows may cause abortion due to severe pain associated with the scouring. Candlenut meal or oil is not recommended as pig food.

Silage.

Silage is not recommended as a suitable food for pigs. However, it has been used for brood sows and older stock during times of drought, and growing stock have been allowed a small percentage in their ration when green feed or root crops have not been available. Its palatability is usually poor.

Skim Milk and Buttermilk.

In supplementary value, skim milk and buttermilk excel any other single feed. They are especially recommended for pigs just weaned, as they are very palatable and digestible. They usually contain between 3 and 4 per cent. protein, and supplement well the proteins of farm grains. Skim milk and buttermilk also are rich in essential mineral elements.

While these feeding stuffs are of equal value for pigs, precautions should be taken to see that the buttermilk has not been diluted with wash water. Both should be pasteurized or boiled in order to prevent the possibility of tuberculosis. Their high value is shown by the fact that roughly 500 lb. can be considered worth as much as a bushel of maize.

When these by-products are fed in small amounts they have a higher value per pound than when they form a large proportion of the ration. Young pigs require larger proportions of milk to grain than do older pigs. It will be found that about one gallon of skim milk or buttermilk per day will balance a maize ration for pigs from weaning age to market weights. During the period of rapid growth (between 90 and 130 lb.), $1\frac{1}{2}$ to $1\frac{3}{4}$ gallons may be utilized very profitably.

Buttermilk Powder.

Buttermilk powder has an approximate analysis of protein 35 per cent., fat 4 per cent., ash 10 per cent., and moisture 8.5 per cent. As a source of protein, buttermilk powder has approximately three-fifths the value of 55 per cent. meatmeal. Due to the high biological value of milk foods, the quantity fed could be the same as meatmeal, provided a vegetable protein is fed as additional supplement. The cost of this product is usually too great to permit its use as pig food, but small quantities could be fed with meatmeal and in this way relieve the meatmeal supply position.

Whey.

Whey is a good food for all classes of pigs, and if used in proper balance with other foods gives results similar to those obtained by feeding separated milk. Whey is lower in protein content, and its total food value is only half that of skim milk. This does not necessarily mean that twice the volume of whey must be fed to obtain similar results in pig feeding.

Whey must be fed while fresh, and should be kept as clean as possible; this means collecting the whey daily if practicable. Never put fresh whey into drums containing stale whey. Dirty and stale whey is responsible for many of the digestive disorders occurring in whey-fed pigs, particularly weaners and stores.

Pigs should be given small amounts of fresh whey at about six weeks of age to accustom them to the ration that they will receive when weaned. They should also receive a small amount of grain at this stage. Start with a pint of whey daily per pig, and gradually increase the whey so that at eight weeks of age each pig receives one gallon daily. The grain should have been increased to 1½ lb. daily by this time. A week before weaning commence feeding a protein-rich food such as meatmeal (55 per cent. protein); 2 oz. is sufficient to start with, but gradually increase so that at weaning each pig receives 4 oz. daily. This amount of meatmeal is not increased further as the pigs grow, but the whey and grain are increased gradually, grain at the rate of 4 oz. per week per pig, and whey just as much as the pig will drink comfortably. The feeding of large quantities of whey to young pigs is responsible for the unthrifty pot-bellied appearance often seen in whey-fed pigs.

Relative Value of Feeding Stuffs.

One pound of grain (barley, wheat, maize or sorghum) is approximately equal to—

4 lb. sweet potatoes.
4 lb. English potatoes (boiled) or artichokes.
5 lb. arrowroot.
6–8 lb. pumpkins or apples.
8–9 lb. mangolds, turnips, or carrots.
5–10 lb. green pasture or forage crops.
10 lb. separated milk or buttermilk.
9–15 lb. kale, kohl rabi, cabbage, cauliflower or melons.

Advice on Feeding.

If you have a feeding or husbandry problem consult one of the following Advisers, Pig Branch, stationed at the undermentioned centres:—

Atherton ..	T. Abell	Murgon ..	C. R. Grieve
Biloela ..	J. Christensen	Toowoomba ..	C. Porter
Brisbane ..	E. L. Melville	Warwick ..	J. N. Liddell

PESTS AND DISEASES HANDBOOK.

The second edition of Volume III of the "Queensland Agricultural and Pastoral Handbook" is now available from the Department of Agriculture and Stock.

The description and control of pests and diseases which affect most of the farm and orchard crops grown in Queensland are set out. There is also a chapter on insecticides and fungicides and one on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for £1, post free in the British Commonwealth.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 25th JUNE, 1953.)

Breed.	Owner's Name and Address.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H.M. State Farm, " Palen " Stud, Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
	L. Puschmann, " Tayfeld " Stud, Taylor
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
	W. F. Ruhle, " Felbar " Stud, Kalbar
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah

TESTED HERDS—continued.

Breed.	Owner's Name and Address.
Large White	K. A. Hancock, " Laurestonvale " Stud, Murgon
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, " Kybong " Stud, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	J. A. and J. McNicol, " Camden," Canning Vale, Warwick
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, " Lauraven " Stud, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
	N. E. Meyers, Halpine Plantation, Kallangur
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
	G. I. Skyring, " Bellwood " Stud, *via* Pomona
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, " Canaan " Stud, Riverview
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	A. J. Surman, " Namrus " Stud, Noble road, Goodna
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H.M. State Farm, Numinbah
	D. B. Alexander, " Debreczen " Stud, Kinleymore, *via* Murgon
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
	A. Curd, " Kilrock " Stud, Box 35, Jandowae
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	R. A. Collings, " Rutholme " Stud, Waterford
	M. Nielsen, " Cressbrook " Stud, Goomburra

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 25th JUNE, 1953.)

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus Stud," Greenmount
	H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmer " Stud, Wondai
	W. G. Marquardt, " Springlands," Wondai
	A. C. and C. R. Marquardt, " Cedar Valley," Wondai
	A. H. Sokoll, " Sunny Crest " Stud, Wondai
	W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt
	G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, " Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, " Grovely," M.S. 195, Pittsworth
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	" St. Christopher's and Iona " Studs, Brookfield road, Brisbane
	E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
	C. E. R. Dudgeon, " Marionville " Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount
	J. F. Lau, " Rosallen " Jersey Stud, Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, " Yarradale," Yarraman
	A. L. Semgreen, " Tecoma," Coolabunia
	G. & V. Beattie, " Beauvern," Antigua, Maryborough
	L. E. Meier, " Ardath " Stud, Boonah
	A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango
	F. W. Verrall, " Coleburn," Walloon
	C. Beckingham, Trout road, Everton Park
	W. E. O. Meier and Son, " Kingsford " Stud, Alberton, *via* Yatala
	G. H. Ralph, " Ryecome," Ravensbourne
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

MARKETING

Movements in the Wholesale Price of Lucerne—Brisbane, 1948-52.

PREPARED BY OFFICERS OF THE DIVISION OF MARKETING.

THIS analysis of lucerne chaff and lucerne hay prices on the Brisbane market is intended to throw some light on the nature of the market, its fluctuations, seasonal movements and existing trends, and also to provide a detailed picture of the course of prices since the beginning of 1948.

GENERAL REMARKS ON PRODUCTION AND MARKETING.

In order that the various price movements might be more fully understood, a cursory examination of the basic price data and certain aspects of production and marketing is essential.

Prices Information Collected.

Data relating to the Brisbane market have been collected by the Market Price Reporting Section of the Division of Marketing. Complete recordings are made in respect of consignments submitted to auction, the items enumerated being quantity displayed for sale, quantity sold at auction and the various prices realised. The bulk of the produce offered each day at auction usually comprises consignments direct from grower to agent, and these consignments account for about half of the total receivals for both auction and private sale. Also auctioned is a portion of those consignments which represent purchases in the producing districts by various merchants. The balance of these latter consignments is either sold by private treaty prior to the commencement of auction sales or taken direct into store.

It is estimated that the recorded data of daily auction sales directly covers about 80% of total receivals in Brisbane, and inasmuch as some private treaty sales are made at "market rates", the overall coverage is even higher. Consequently, it is considered that the various averages which have been based on these data are fully representative. Detailed figures of average monthly prices of both lucerne chaff and hay are given in Tables 3 and 4.

Production.

The bulk of Queensland's commercial lucerne crop is produced in the Statistical Division of Moreton, principally on the deep fertile soils of the Brisbane, Fassifern, Lockyer and Logan Valleys. During the 5-year period 1947-48 to 1951-52, production in this division accounted for 62·5% of the State total, which averaged 89,788 tons per annum. Comparative figures for the other main statistical divisions were Downs

20%, Maryborough 13% and Rockhampton 4%. The relevant production figures are set out in Table 1. It should be borne in mind when referring to this table that at the time of harvest all cut lucerne is classified as hay and naturally includes that which is later converted into chaff.

TABLE 1.

LUCERNE HAY.

Area and Production in Main Statistical Divisions.

(Source—Queensland Government Statistician).

Statistical Division.		1947–48.	1948–49.	1949–50.	1950–51.	1951–52.
Moreton ..	.. Acres	22,407	21,434	21,744	16,693	14,744
	Tons	62,927	60,232	63,252	52,664	41,893
Maryborough	.. Acres	6,176	5,373	6,258	4,443	3,925
	Tons	13,783	11,732	14,483	10,612	7,678
Downs ..	.. Acres	16,158	11,530	11,250	11,084	9,037
	Tons	22,756	16,665	16,753	19,923	13,225
Rockhampton	.. Acres	1,773	1,724	1,983	1,586	1,956
	Tons	3,389	3,695	3,608	3,644	4,088
Rest of State	.. Acres	284	270	220	141	129
	Tons	501	494	388	334	222
Total State..	.. Acres	46,798	40,331	41,455	33,947	29,791
	Tons	103,356	92,818	98,484	87,177	67,106

It will be seen from the table that during the last five years there has been a decline in both the area planted to lucerne for commercial purposes and the quantity harvested. In 1947-48, 103,356 tons of hay were harvested from an area of 46,798 acres, whereas in 1951-52 the corresponding figures were 67,106 tons from 29,791 acres, a fall of approximately 35%.

Marketing.

Lucerne is marketed either as chaff or as hay. Over the last few years, receivals on the Brisbane Market have shown a tendency for the proportion of hay to increase at the expense of chaff. The average weekly receivals during 1948 were approximately 5,550 bags of chaff and 2,220 trusses of hay. Much the same ratio was preserved during 1949 and 1950, but in 1951 the average weekly figures were 4,140 bags of chaff and 4,170 trusses of hay. The apparent swing in favour of hay as the marketing medium continued during 1952, when comparative averages were 2,710 bags and 3,310 trusses respectively.

Various reasons can be advanced to explain this development but the relative importance of each is not readily apparent. However, the prime causes would seem to include (i) the more extensive use of mechanised balers; (ii) the high cost of bags; and (iii) the greater demand for hay for the hand feeding of stock during prolonged dry weather. The third cause is seasonal, and as the last two years of the period studied were "drought" years from the point of view of the livestock industries, the actual trend in favour of hay is probably less marked than the above figures seem to indicate.

With reference to the cost of bags, the maximum price of No. 1 quality chaff bags within the City of Brisbane area was 22s. per dozen

in July, 1947, and rose steadily to 50s. 3d. by August, 1951. The position eased slightly during the first half of 1952 and the maximum price was reduced to 43s. 3d. per dozen by the middle of the year.

These changes in the proportions of hay and chaff marketed comprise the only significant divergence between the two types over the period. A comparison of the data relating to all other aspects, including weekly fluctuations, seasonal pattern and general trend, reveals a marked similarity. Consequently, for the sake of brevity, the detailed description which follows is confined to lucerne chaff.

SEASONAL PATTERN OF PRICES.

There is a definite and fairly regular seasonal pattern in lucerne prices. This results mainly from the nature of demand and is affected only to a minor extent by supply.

Demand Factors.

In normal seasons the demand for lucerne comes almost entirely from the dairying and poultry industries, and as this demand follows a fairly regular and well-defined pattern, it is naturally reflected in lucerne prices.

The demand for lucerne by the dairying industry, which is by far the largest consumer, is quite different in character from that of the poultry industry, being essentially of a seasonal nature, and it is evident that this factor is primarily responsible for the fairly regular seasonal pattern apparent in lucerne prices. Table 2 shows dairy cattle populations in each of the main statistical divisions of the State.

TABLE 2.

DAIRY CATTLE IN MAIN STATISTICAL DIVISIONS.

(Source—Queensland Government Statistician).

Statistical Division.	Number at 31st March (Thousands).					
	1947.	1948.	1949.	1950.	1951.	1952.
Moreton ..	403	427	429	417	416	387
Maryborough	346	358	376	380	388	331
Downs ..	311	298	302	315	315	291
Rockhampton	170	185	198	202	203	177
Rest of State	102	115	118	119	118	111
Total State	1,332	1,383	1,423	1,433	1,440	1,297

The requirements of the poultry industry take the form of green leafy lucerne for use either as green feed or in the preparation of poultry foods. The factor determining the strength of this demand at any time is the total number of fowls, and this is governed more by general economic conditions in the industry than by any seasonal influence. Consequently, the cause of seasonal pattern in lucerne prices lies elsewhere than in the demand from the poultry industry.

Another outlet for lucerne is the pastoral industry. With much of this industry located in the drier portions of the State, where natural grasses provide the main source of fodder, its demand is somewhat erratic. This is largely responsible for the recurrent episodic disturbances to the normal seasonal pattern. This aspect is dealt with later.

Supply Factors.

The supply of lucerne chaff and hay to the Brisbane Market itself exhibits a definite seasonal pattern. Good supplies come forward during the first two or three weeks in January but fall off rapidly towards the end of that month. The next eight weeks (that is, February and March) mark the period of lightest supply and thereafter receivals increase until September. A slight decline occurs during October but supplies reach their peak in November. Then follows a fairly sharp reduction during December, when quantities available are somewhat on a par with January.

Although supplies exhibit a fairly regular seasonal pattern, their influence as a factor causing seasonal variation in the price of lucerne is comparatively slight. In the first place, most of the commercial stands are irrigated and cuttings can be made throughout the year. Moreover, yields are fairly constant and the volume of production is determined mainly by acreage. Secondly, with the exception of cuttings from fields carrying a heavy weed growth, lucerne need not be a perishable commodity. Provided sufficient skill is exercised during the cutting and curing, lucerne can be stored for very long periods. These factors tend to make supply rather elastic, and the quantities marketed are usually more sensitive to changes in price than are changes in price to the quantity marketed.

Description of Seasonal Pattern.

The seasonal patterns of both supplies and prices are illustrated by Plate 1, which has been prepared in part from the monthly price averages given in Tables 3 and 4.

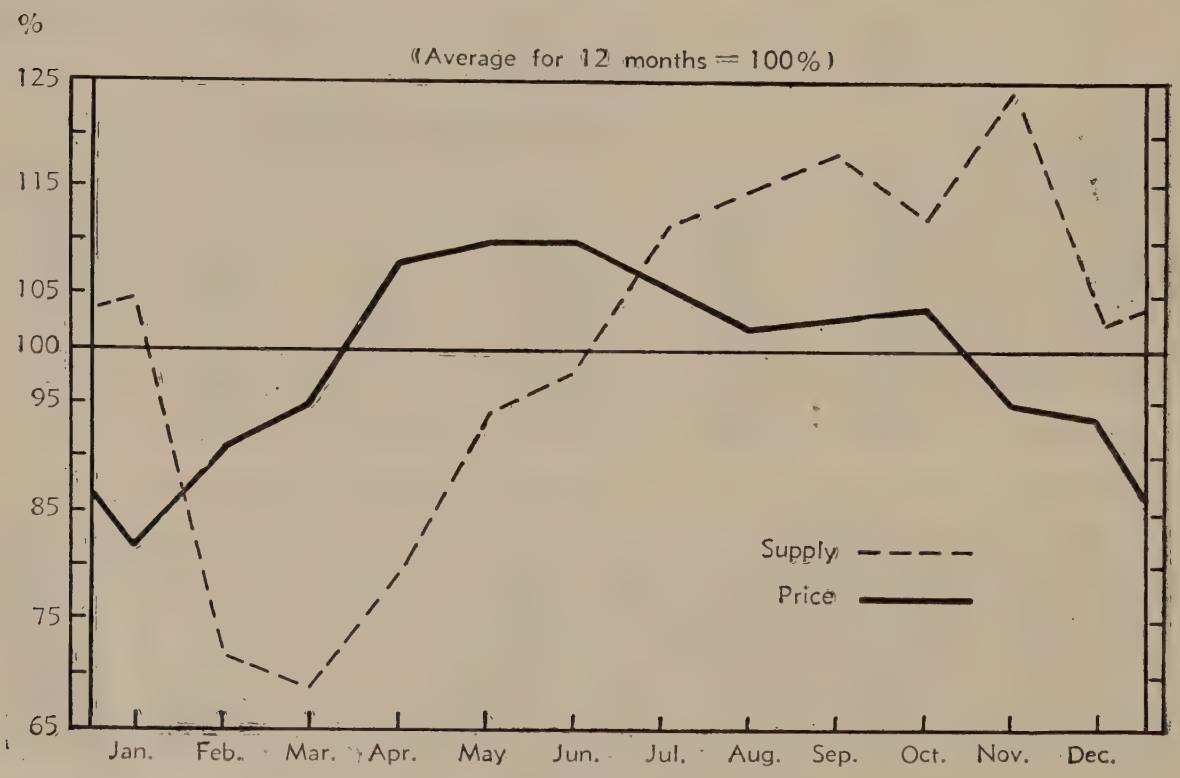


Plate 1.

Lucerne Chaff. Seasonal movements of supply and price computed from monthly averages for the period 1-1-48 to 31-12-50. (Average for 12 months—100%.)

TABLE 3.

LUCERNE CHAFF.

Average Monthly Prices.

(Auction Sales—Roma St. Goods Shed)

Month.	Price per Ton.														
	1948.			1949.			1950.			1951.			1952.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
January ..	8	1	8	9	13	10	10	4	7	13	14	4	37	13	4
February ..	10	7	9	10	6	0	10	14	3	15	4	10	48	9	5
March ..	11	13	7	10	1	10	11	10	3	15	19	11	37	0	2
April	12	2	9	11	17	10	14	3	3	18	4	2	33	19	8
May	11	8	11	12	15	0	14	10	4	24	1	7	34	14	5
June	10	15	7	13	1	3	15	0	10	24	11	10	30	2	10
July	10	14	10	14	3	4	13	3	1	26	2	0	32	0	6
August ..	11	8	7	13	4	7	12	0	5	34	19	5	25	4	1
September ..	11	10	11	12	2	5	13	11	7	32	18	1	19	16	4
October ..	12	19	8	11	3	3	13	17	2	35	12	0	16	1	4
November ..	13	2	4	9	11	5	12	2	8	45	16	0	14	8	1
December ..	11	11	0	9	16	6	13	12	2	55	16	9	16	15	2

TABLE 4.

LUCERNE HAY.

Average Monthly Prices.

(Auction Sales—Roma St. Goods Shed)

Month.	Price per Ton.														
	1948.			1949.			1950.			1951.			1952.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
January ..	4	12	2	6	9	5	6	8	1	6	19	11	22	15	3
February ..	6	4	2	6	18	4	7	0	8	9	4	4	35	3	0
March ..	6	8	8	5	10	4	7	12	10	9	8	0	24	15	7
April	8	13	6	7	3	1	8	6	10	10	19	0	21	3	1
May	8	7	0	7	9	0	8	9	9	13	13	6	20	4	7
June	7	18	2	8	4	5	10	5	0	12	13	2	17	13	2
July	6	7	0	8	1	7	9	7	4	13	0	2	19	11	1
August ..	8	7	6	8	11	10	7	14	8	19	10	6	16	13	2
September ..	8	1	8	8	1	9	8	9	3	21	4	9	13	0	0
October ..	9	9	6	6	7	1	8	8	2	21	2	11	11	0	1
November ..	9	6	0	5	19	0	7	2	0	36	15	3	10	0	5
December ..	8	5	4	5	15	0	7	2	5	41	14	9	11	3	4

The seasonal price pattern for lucerne consists of two distinct phases. A trough of low prices occurs during the summer months, with the lowest point in January, whilst during the cooler April-October period prices remain at a higher and more uniform level.

The low level of prices during January results from a combination of factors. Firstly, the dairying districts register their greatest rainfall during the summer, when excellent growing conditions exist. Consequently, there is usually an abundance of natural fodder, which results in a comparatively weak demand for lucerne. Secondly, good supplies of lucerne are usually placed on the market during January, especially during the first three weeks.

The reaction to the low January prices is a sharp drop in supplies which occurs about the fourth week. The quantities of lucerne received over the next eight weeks (that is, during February and March) continue to be very light, and a gradual recovery of prices is effected despite the prevailing weak demand. Trading in lucerne over this period nevertheless remains slack.

A brighter note is usually found in April, when an improvement in demand ensures that prices continue to rise even though an increase in supplies also occurs. Much the same factors operate during May and June, although the rate of increase in demand is diminishing during those months and prices are only slightly above the April level. Generally speaking, demand is fairly stable over the late winter months, but the grazing of winter grain crops is fairly extensive and as supplies continue to increase during July, August and September, prices tend to be somewhat lower. However, the general level remains fairly high.

There is another feature common to the winter period as a whole —this is the greater frequency and magnitude of fluctuations in weekly average prices. This feature is readily apparent in most of the years under consideration, and reference to the accompanying graphs roughly locates the general period of occurrence from the 18th to the 40th week of the year.

Although prices show a further slight rise during October, this month really marks a downward change in the seasonal pattern. This change becomes apparent over the closing stages of the month, with values becoming increasingly difficult to maintain, and during the next few weeks, when deliveries usually reach their peak, a fall in prices is experienced. This fall during November is largely explained by a reduction in the demand for lucerne following the normal seasonal improvement in the growth of natural grasses.

Much the same factors influence the market during December, yet the further drop in prices is usually only slight. The reason for this is that the effect of the continued decline in demand is to a large degree offset by a substantial reduction in the quantity of lucerne coming forward for sale. During the ensuing month a slightly greater volume of supplies is maintained and this results in a resumption of the falling price level, which, as explained earlier, is characteristic of trading during the first half of summer.

Variations from Seasonal Pattern.

Nearly all variations from the seasonal pattern of lucerne prices are caused by episodic disturbances of a climatic nature. Most are of a minor character, but when drought occurs in the dairying and pastoral districts major variations result.

In the following paragraphs detailed comment is given on both minor and major variations during the whole of the period under review, the only major variation being in 1951-52. For the sake of ease of reference the variations are treated chronologically.

During 1948, prices rose more sharply than usual in February (from £7 10s. to £13 per ton) and the normal levelling out was advanced from April to March. This was primarily the result of a below-average rainfall in February. The next variation occurred during the late winter months, when dry, windy conditions caused a slight firming of prices at a time when the normal pattern shows a slight downward trend. An

extension of this movement followed the failure of the late spring and early summer rains, and prices continued at a fairly high level until the end of November.

Early 1949 was also dry and good summer rains were not experienced until February and March. As the market was fairly well supplied during those months, the normal rise in prices was delayed until April. However, the price rise in April was quite steep and reflected the rapid reduction in the nutritional value of pastures caused by severe early frosts. Prices held very well throughout the winter, as demand was better than usual because five successive months of below-average rainfall left the pastoral areas fairly dry.

During 1950, movements in prices for the most part showed a high degree of correlation with the normal seasonal pattern. However, a sharp drop in prices during July resulted from a temporary falling off in demand produced by mild midwinter conditions and exceptionally good rains.

The next two years found the dairying and pastoral industries in the grip of a prolonged drought and the normal price pattern just did not exist.

In 1951 the outlook for the winter was poor when April and May became the third and fourth successive dry months. Early frosts and persistent dry westerlies caused rapid deterioration in pastures and resulted in an abnormally strong winter demand, particularly from the dairying districts. In fact, average weekly prices advanced from £18 per ton at the end of April to £35 per ton in October.

Only scattered thunderstorms were received during the spring and summer, and these falls were mainly confined to the coastal areas. Consequently, demand from the dairying industry remained high and to it was added a very strong request from the pastoral areas, where the hand feeding of stock had become vital. Prices during this period rose quickly, reaching a peak of £60 per ton in the second week of December.

Early in 1952, useful relief rains in the dairying districts brought about a moderate fall in prices. This was accentuated in April, when most central and southern pastoral districts received above-average rainfall. However, these rains were hardly sufficient to replenish surface water and although prices dropped quickly to £35 per ton, there was only a slight easing over the next four months. August prices registered a drop of £10 per ton when further rains fell in the dairying districts, but it was not until the widespread heavy rain in October brought relief to the north-western pastoral districts that the demand for lucerne returned nearly to normal.

TREND.

Lucerne prices covering the 5-year period 1948 to 1952 have been analysed for trend, but in view of the occurrence of marked episodic disturbances over the last two years, the actual mathematical fitting of a line of trend was restricted to the period from January 1948 to January 1951.

The analysis has revealed a steady upward movement in prices. This has resulted in a basic increase in values totalling about 40% over the five years, or an increase of approximately 18s. per ton per year in the basic average price of lucerne chaff.

This movement is subsequently referred to as the basic trend in lucerne prices and it is illustrated diagrammatically in Plate 2.

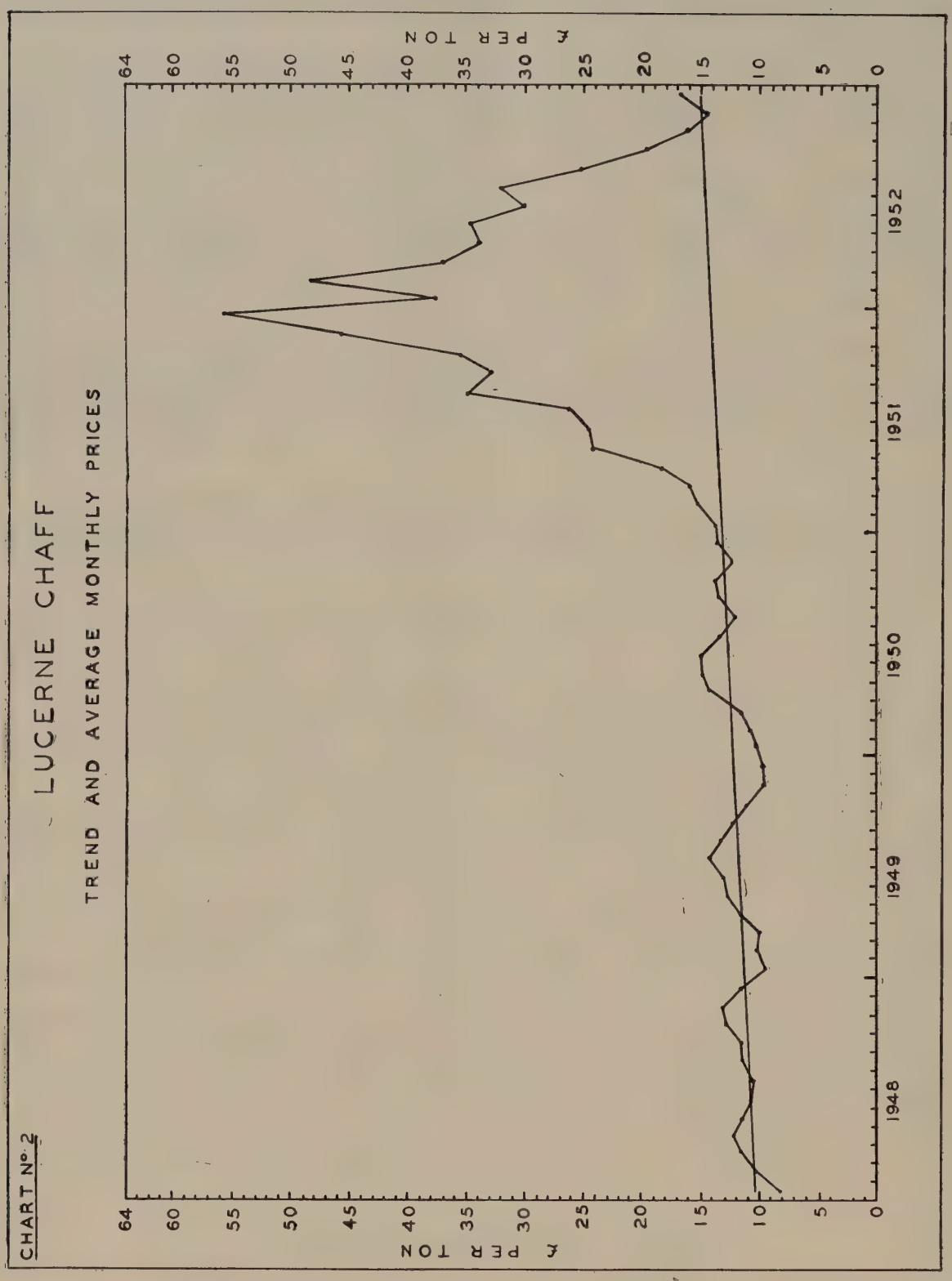


Plate 2.

Lucerne Chaff. Trend and average monthly prices, 1-1-48 to 31-12-52.

Reference to this graph will show that during the first three years prices displayed a very definite tendency to fluctuate closely about the line of trend within the limits imposed by the seasonal pattern. The reason for this basic trend in lucerne prices cannot be found in any inherent changes in either the supply of or the demand for the commodity, but can only be ascribed to the underlying economic conditions of the period.

The trend line has been extrapolated through the abnormal years 1951 and 1952 without reference to the actual data of those two years. It is interesting to note that the average weekly prices over the last 10 weeks of 1952 showed a remarkable tendency to return to the level of the trend line fitted as above, and more recent data tend to confirm this.

Whilst it appears that the seasonal price pattern is again fluctuating about the same line of trend as existed during the 1948-50 period, it is possible that the somewhat changed economic conditions of the present may result in a new short-term trend with a more gentle upward slope.

Although some years must necessarily elapse before definite measurement of any such new trend will be possible, an extension of the trend line shown in Plate 2 should provide a reasonably good guide to the basic price level of the immediate future.

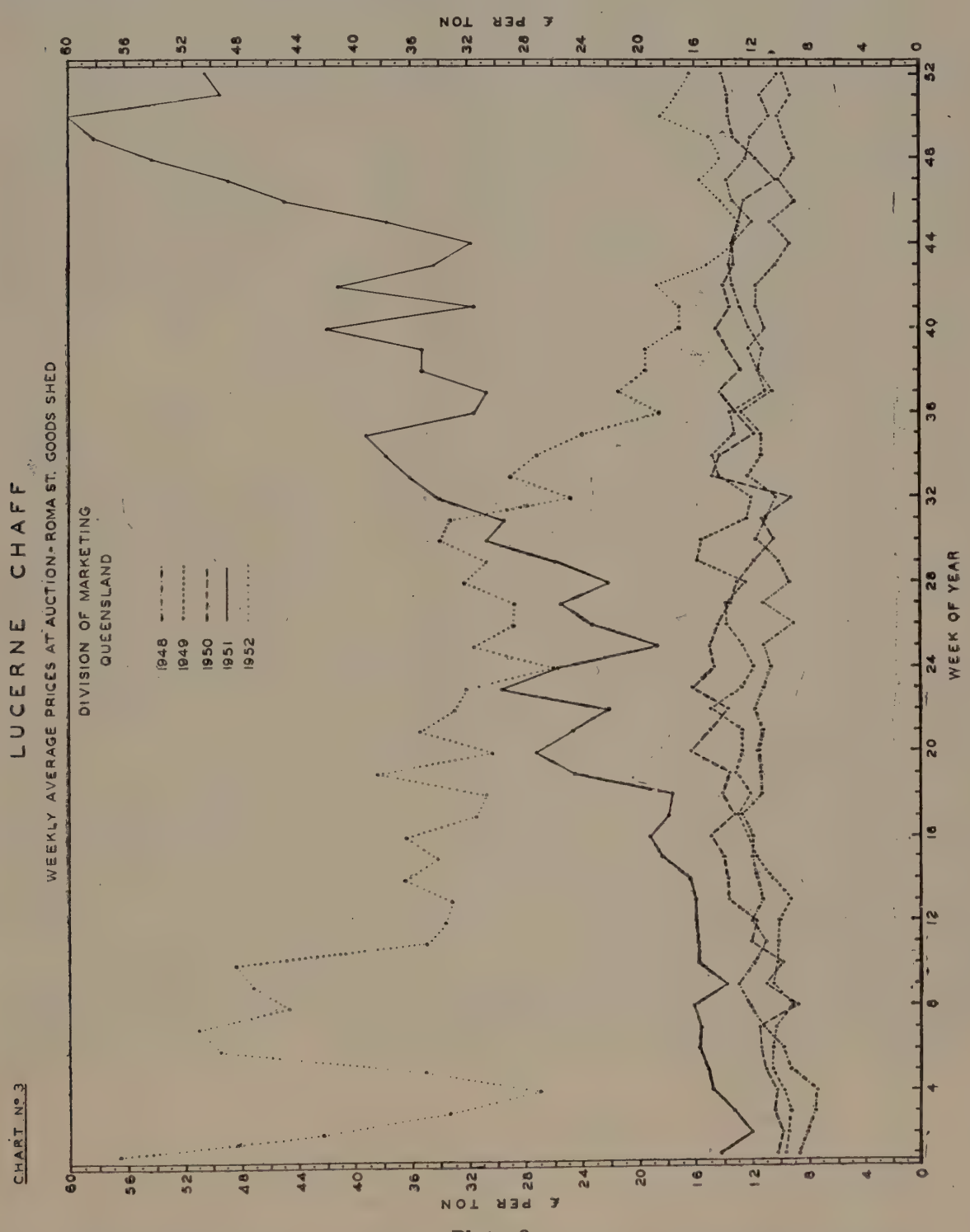


Plate 3.

Lucerne Chaff. Weekly average prices at auction, Roma Street goods shed. 1-1-48 to 31-12-52.

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.18	Cairns	17	41	Longreach	29	40
6	6.27	5.21	Charleville	26	28	Quilpie	36	34
11	6.23	5.23	Cloncurry	41	58	Rockhampton ..	4	16
16	6.19	5.26	Cunnamulla ..	30	28	Roma	16	18
21	6.14	5.28	Dirranbandi ..	21	17	Townsville	15	35
26	6.10	5.31	Emerald	14	24	Winton	33	47
31	6.04	5.33	Hughenden ..	26	44	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	11.36	9.59
2	..	10.40
	a.m.	
3	12.41	11.24
	p.m.	
4	1.45	12.13
5	2.46	1.08
6	3.42	2.05
7	4.33	3.04
8	5.17	4.02
9	5.55	4.59
10	6.29	5.54
11	7.00	6.47
12	7.29	7.39
13	7.57	8.30
14	8.25	9.22
15	8.54	10.15
16	9.27	11.10
17	10.03	..
		a.m.
18	10.44	12.07
19	11.32	1.05
	p.m.	
20	12.28	2.03
21	1.29	2.59
22	2.35	3.52
23	3.43	4.40
24	4.52	5.23
25	6.01	6.03
26	7.08	6.41
27	8.16	7.19
28	9.23	7.57
29	10.30	8.37
30	11.37	9.21
31	..	10.10

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	13	14	28	40	3	16	32	47
6	12	27	27	43	2	18	30	51
11	15	21	31	38	7	12	35	43
16	25	13	42	28	17	2	49	31
21	30	10	45	24	20	0	53	27
26	19	19	35	34	10	10	39	39
31	10	29	25	44	0	20	27	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	41	39	58	24	44	13	35
3	10	46	37	61	22	47	9	38
5	5	55	35	67	19	52	5	45
7	6	51	35	64	20	50	6	43
9	13	43	39	59	24	45	12	36
11	21	34	44	54	29	39	18	29
13	31	24	51	46	35	32	25	21
15	40	15	57	41	42	26	33	14
17	48	11	63	38	48	23	40	11
19	54	5	67	34	51	20	44	6
21	54	4	67	33	51	19	44	5
23	45	10	61	37	46	23	37	10
25	34	21	53	44	38	29	28	18
27	22	33	45	54	30	38	19	29
29	11	44	38	60	23	46	10	37
31	5	52	35	65	19	50	5	44

Phases of the Moon.—Last Quarter, August 2, 1.16 p.m.; New Moon, August 10, 2.10 a.m.; First Quarter, August 18, 6.08 a.m.; Full Moon, August 25, 6.21 a.m.; Last Quarter, August 31, 8.46 p.m.

On August 15 the sun will rise and set 16 degrees north of true east and true west respectively, and on the 13th and 26th the moon will rise and set approximately at true east and true west respectively.

On August 9 there will be a partial eclipse of the sun, visible over the southern tip of South America and the adjacent Pacific Ocean.

Mercury.—A morning object all this month, On the 1st, in the constellation of Gemini, will rise ¾ hour before the sun. On the 13th it will reach greatest angle west of the sun and on the 23rd will pass close to Mars. At the end of August, in the constellation of Leo, near Regulus, it will rise only 15 minutes before the sun.

Venus.—At the beginning of the month, in the constellation of Taurus, will rise 2 hours 50 minutes before the sun, and on the 25th will pass close to Pollux. At the end of the month, in the constellation of Cancer, it will rise 2 hours before sunrise.

Mars.—In the constellation of Cancer, at the beginning of the month is still too close to the sun to be seen. At the end of the month, in the constellation of Leo, it will rise only 47 minutes before the sun.

Jupiter.—In the constellation of Taurus, will rise between 3 a.m. and 4.30 a.m. at the beginning of the month and between 1.30 a.m. and 3 a.m. at the end of the month.

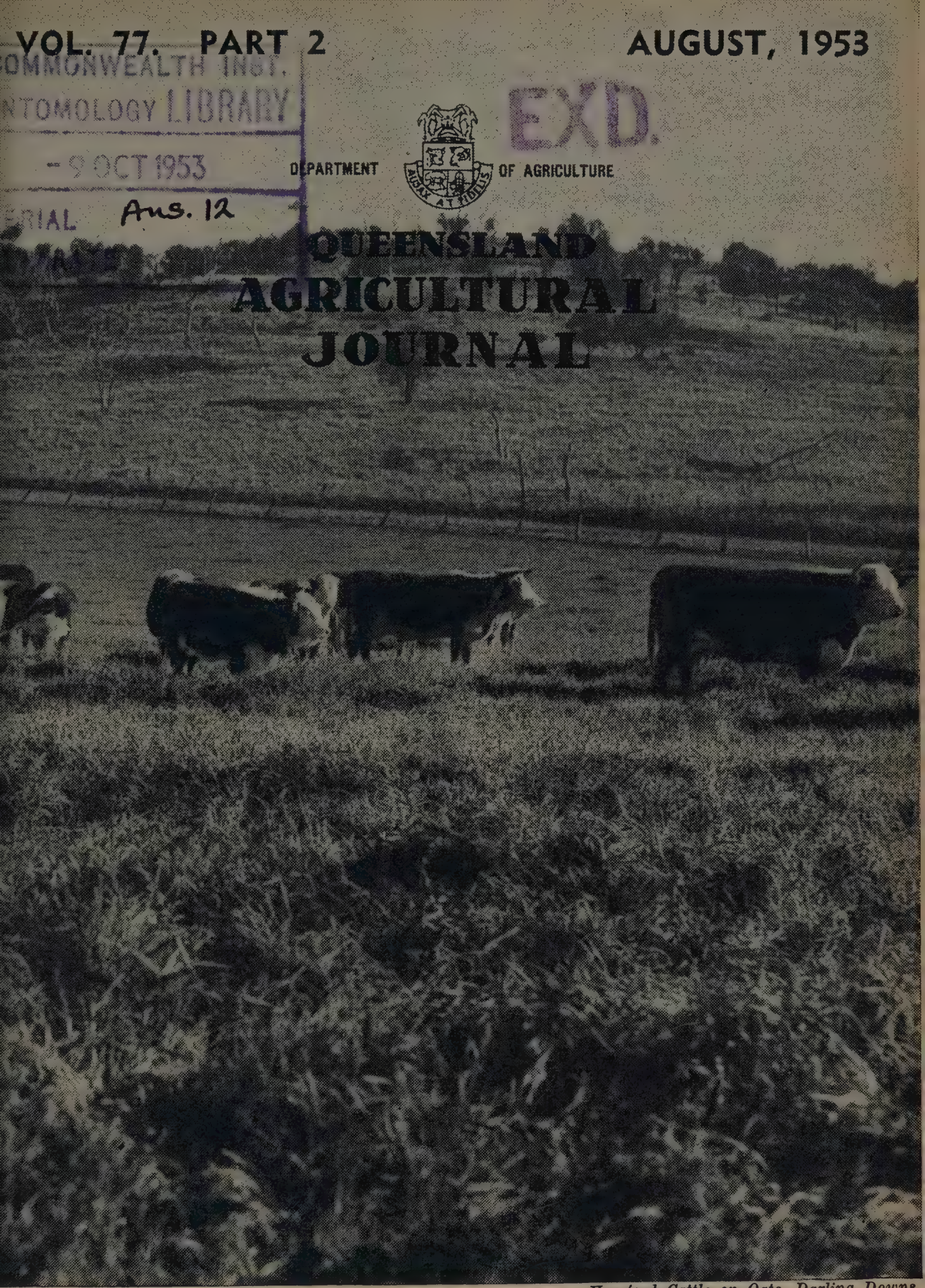
Saturn.—In the constellation of Virgo, will set between 10.50 p.m. and midnight at the beginning of the month, and between 8.30 p.m. and 10 p.m. at the end of the month.

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Volume 77 Part 2

QUEENSLAND AGRICULTURAL JOURNAL

Edited by
C. W. WINDERS, B.Sc.Agr.



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The Pineapple.

P. MITCHELL (Senior Adviser in Horticulture) and R. C. CANNON (Senior Horticulturist).

THE pineapple, which is indigenous to tropical South America, was introduced to Europe at the end of the 15th century and has since been established in most tropical countries. The pineapple-canning industry is now one of the most important fruit-canning industries of the world, accounting for 20% of the total canned fruit production.

The cultivated pineapple (*Ananas comosus* Merr.) is a monocotyledon of the order Bromeliaceae, and is the only representative of the group which is of economic importance. The plant (Plate 1) is terrestrial in habit, though most other species in this order are epiphytes—that is, plants which cling to others for support without deriving nourishment from them. Its epiphytic relationships are revealed, however, by its ability to remain alive for several months without any contact with the soil. Like most such plants, the pineapple is xerophytic, being able to live and reproduce under relatively arid conditions.

HISTORY.

Pineapples were first introduced to Queensland, probably from India, in 1838 and were then grown at Nundah, Hamilton and Nudgee. For many years, the limitations of transport restricted commercial production to the metropolitan district, which provided the main market. Later, as road and rail communications improved and provided access to more distant markets, the industry expanded along the Near North Coast with its centre at Woombye. At the same time, small areas were established in other coastal districts from the southern border to Cooktown, primarily to cater for local requirements, but with some surplus for export to southern markets.

The initial development of the industry in Queensland followed a market demand for fresh fruit, and as production began to outstrip this demand, attention was given to processing. Small trial shipments of canned pineapples were exported to Great Britain and European countries, as well as India and Canada, as far back as 1892. The Queensland pack, however, was insufficient at that time to meet Australian requirements, and substantial quantities of Malayan canned pineapples were imported to make up the deficiency.

At this stage, many growers were canning surplus fruit not required for the fresh fruit market. In a few years, however, these small processing plants were displaced by larger proprietary canneries operating in the Brisbane area. Following a sharp rise in production about 1920, when extensive plantings in soldier settlements in southern Queensland came into bearing, the State Government erected a well-equipped factory in Brisbane to cope with the increased volume of fruit.



Plate 1.

Smooth Leaf Pineapples. An Innisfail district plant crop ready for harvesting in the summer.

From 1924 to 1931, the pineapple industry remained fairly stable, but early in the 1930's markets for both fresh and canned pineapples virtually collapsed. This collapse was accompanied by the widespread occurrence of wilts, characterised by root failure and plant decline. Intensive investigations were undertaken, and within a few years new methods of soil and crop management had been adopted and production was on the increase. Prices for both fresh and canned fruit also improved steadily until the early 1940's, when the whole output of canned pineapple was requisitioned for the armed services. It was during this period that a growers' co-operative cannery was erected at Northgate, near Brisbane.

STRUCTURE AND FRUITING OF THE PINEAPPLE.

The pineapple is an herbaceous perennial plant, growing to a height of 2-4 feet, depending on the variety and the conditions under which it is grown. It has a dense, shallow root system, arising from the axils of the leaves at the base of the stem and concentrated in the upper six inches of soil.

The long, fleshy, trough-like leaves are arranged spirally around the stem, and collect rain or dew, which is directed to the roots near the base of the plant. They are also provided with large water-storage cells, which enable the plant to withstand dry conditions.

The fruit is a compound structure, consisting of a number of fruitlets or "eyes", each of which is formed from a single flower, and its size is governed by the number of eyes and their subsequent development. The fruit arises from the apex of the stem at the centre of the plant, only one fruit being borne on each stem. The fruit stalk runs through the fruit, as the core, and terminates in a cluster of small leaves constituting the "top" or "crown".

In vigorous plants, offshoots, usually known as "slips", but sometimes called "gill sprouts", "buttons" or "robbers", arise from the fruit stalk as the fruit matures. Each has a small pinelet at its base which is anatomically the same as a fruit although it does not develop any further on the parent plant. If removed and planted, a slip grows into a plant which will fruit in the ordinary way. Slips are produced most prolifically by plants flowering in the spring and bearing a summer crop of fruit.

Another type of offshoot, the "sucker", is purely vegetative, and arises in a leaf axil of the stem. Suckers on a plant crop produce the first ratoon and their suckers in turn produce the second ratoon, and so on. The number of suckers on any plant depends on its vigour and the growing conditions encountered. Usually plants carrying a summer crop are more productive of suckers than those bearing a winter crop.

In southern Queensland, the pineapple plant flowers within 12-18 months from planting, the period depending on the type of planting material and the time of planting. Summer fruit take about five months to mature, whilst winter fruit may take up to seven months. Under optimum conditions the first ratoon crop may be harvested 12 months after the plant crop, but more often than not it will take 18 months, and the same would apply to the second ratoon. These three crops normally constitute the commercially productive life of a pineapple plantation. Allowing for variable weather conditions and irregular fruiting, the complete cycle, therefore, usually occupies about five years.

In the subtropical areas, climatic conditions and irregularity in type, size and vigour of plants usually have the effect of spreading the crop. Consequently, there are in practice four cropping periods in the year, giving a summer, winter and two intermediate crops. This seasonal spread of the crop has some advantages, particularly when both fresh fruit markets and cannery outlets are available.

In the tropics, where summer and winter temperatures are higher and there is a longer growing period, fruit may be harvested within 9-15 months of planting. Under these conditions, the complete crop cycle occupies a shorter period.

PRODUCING DISTRICTS IN QUEENSLAND.

Practically the whole of the Australian pineapple crop is produced in Queensland on frost-free land within the coastal belt. The major producing areas in their order of importance are the Near North Coast, Gympie, Brisbane, Rockhampton, Maryborough, Magnetic Island and Bowen. Large areas in the tropical coastal region are eminently suited

for the production of pineapples, but facilities for transport to markets have limited expansion in the past. The establishment of canneries in the north has been followed by an increase in the area under crop in this part of the State during the last few years.

VARIETIES.

The cultivated varieties of the pineapple may be classified into three main groups—the Cayenne, the Queen and the Spanish. The first is by far the most important group, the Smooth Cayenne being the principal canning variety. Varieties of the Queen group are grown to a lesser extent, exclusively for some fresh fruit markets, but are being superseded by Smooth Cayenne, which is a dual-purpose variety.

The Smooth Cayenne.

The Smooth Cayenne, which presumably originated in French Guiana, is known in England as the Kew pineapple and in Malaya as the Sarawak. The plant is typically stocky and robust, with tapering, fleshy leaves up to 3 ft. in length and $2\frac{1}{2}$ in. in width. The leaf margins are smooth with the exception of a few spines near the tip. The upper surface of healthy leaves is dark olive-green in colour, with an irregular purplish suffusion running along the centre. The flowers are light purple in colour with bright red bracts. The number of flowers on a single spike ranges from 130 to 170, depending on environmental conditions.



Plate 2.

Smooth Cayenne. The most widely grown pineapple variety in Queensland.

The fruit (Plate 2) is large and cylindrical in shape, and weighs about six pounds. Over-sized fruit may taper towards the apex, but this characteristic varies somewhat with seasonal conditions. The fruitlets or "eyes" are typically broad and flat, with inconspicuous dead bracts. As the fruit ripens, it acquires a deep-yellow to coppery-yellow colour, which first appears at the base and progresses upwards to the shoulders. The flesh is firm, close-textured and juicy, with a light-yellow colour at maturity.

Other varieties of this group are the Hilo of Hawaii and the St. Michel of South Africa.

Varieties of the Queen Group.

Varieties of the Queen group were probably the first pineapples to be cultivated, and apparently the first to be grown in Queensland. At the present time two varieties of this group are still grown here—the rough-leaved or Common Rough, and the Ripley Queen and local selections from it.



Plate 3.

Pineapple Varieties. Left, Queen. Right, Ripley Queen.

The plants are characterised by a dwarf, compact habit of growth. The leaves are short, stiff, strongly serrated along their entire margins, and thickly covered with a whitish meal on both surfaces. The flowers are lilac in colour, and the eyes are small and prominent. When fully mature the fruit is bright yellow in appearance, with light yellow, crisp and sweet flesh, and is much less juicy than the Smooth Cayenne.

The Queen or Common Rough (Plate 3) has bluish-green foliage and the fruit is more or less barrel-shaped, with an erect top. The *Ripley Queen* has pale-green foliage, heavily tinged with red, and the

fruit is more conical in shape than the Queen, with a distinctly flattened top. The *MacGregor,* which is a local selection from the Queen, is sturdier, broader-leaved, more vigorous and produces larger and better-shaped fruit. A local selection from the Ripley Queen, the *Alexandra,* is similar to the parent variety, but is more vigorous and produces somewhat larger fruit.

A characteristic of these rough-leaved varieties is their prolific suckering. The small size of the fruit and the solid flesh make them more suitable for the fresh fruit market than for canning, and they are not now processed in Queensland.

The *Pernambuco* and *Abachi* are two varieties of this group which are grown in other countries for dessert purposes.

Varieties of the Spanish Group.

Red Spanish is the principal pineapple variety grown in Cuba and Puerto Rico for the United States fresh fruit trade, but it is not represented commercially in Queensland.

The leaves are long, narrow and spined, and are dark green in colour, often tipped with red. The spike contains only 80-90 flowers and the fruit is consequently much squatter and smaller than that of the Smooth Cayenne. The mature fruit is deep yellow in colour, suffused with red, with a white or pale-straw-coloured flesh. Its flavour is not particularly good, but this is to an extent offset by its excellent carrying qualities.

Other varieties in this group grown in other countries are *Sugar Loaf, Mauritius* and *Cabezona.*

PLANT SELECTION.

In any pineapple plantation, there is usually a range of plant and fruit types. This may be due in part to soil and climatic conditions, which have a marked effect on plant growth; abnormalities due to such conditions are not heritable. On the other hand, sports or mutants can arise from time to time which are inherently different from the parent plant and their progeny will reproduce the same characteristics, whether they be good or bad.

High-suckering and multiple-topped fruit are usually the results of environmental factors. The time of the year when fruit is produced has a pronounced influence on its shape; winter fruit (Plate 4) tends to be more conical in shape than the normal summer fruit, and the "prickly eye" or "Christmas pine" is another seasonal manifestation. Many types of crippled and misshapen fruit are also the result of adverse conditions, such as high altitudes and cold southerly slopes.

Inferior sports, such as "collar-of-slips", "long Tom", "dry fruit" and "bottle-neck", occur from time to time. These are heritable types which, if not eliminated, will eventually be responsible for considerable loss as the proportion of undesirable plants increases in the plantation. At the same time, mutants which are superior to the parent may appear in the crop.

Desirable Plant and Fruit Characteristics.

A good fruit should be long, cylindrical and broad shouldered, with large, flat eyes and a small core. It should be low-set on a short fruit stalk bearing no more than four slips, all set well below the base

of the fruit. The stem of the plant should be relatively short, as tall plants have a tendency to fall over when carrying the fruit. It should have at least two suckers originating close to the ground to ensure a stable ratoon plant. The number of suckers is influenced by growing conditions; a well-grown plant will usually produce more than two. They should be about half-grown by the time the fruit is mature, in which case they will afford a measure of protection to the fruit against sunburn and provide an early ratoon crop.



Plate 4.

Winter-type Fruit of the Smooth Cayenne Pineapple in Queensland. The fruit is conical in shape and set high on the plant.

Undesirable Types.

The number of inherently abnormal strains within the Smooth Cayenne variety is large and at least 15 have been recorded in Queensland plantations. Of these, however, there are only four markedly undesirable types. All of them produce slips prolifically and tend to be multiplied very rapidly on account of the abundance of slips which could be used as planting material.

Collar-of-Slips.—The collar-of slips strain is typified by the presence of a large number of slips arising from the stem close to the base of the fruit, or even directly from the fruit itself (Plate 5). In addition, slips may also be borne lower down the fruit stalk. This excessive slip growth develops at the expense of the fruit and results in small, tapered fruit and a considerable reduction in the yield and quality of fruit. The presence of slips or knobs at the base of the fruit, quite apart from its reduced size, renders it unattractive and the removal of these excrescences increases the liability to fruit rot.

Variations of the true collar-of-slips type, such as "near-collar" and "knobby fruit", also occur. In the former (Plate 6), slips are numerous and clustered around the base of the fruit, though not actually originating at its base. In knobby fruit, slip production may be normal but the base of the fruit carries several knobs which vary in number and size. These are probably only environmental modifications of the true collar-of-slips character. Collar-of-slips and near-

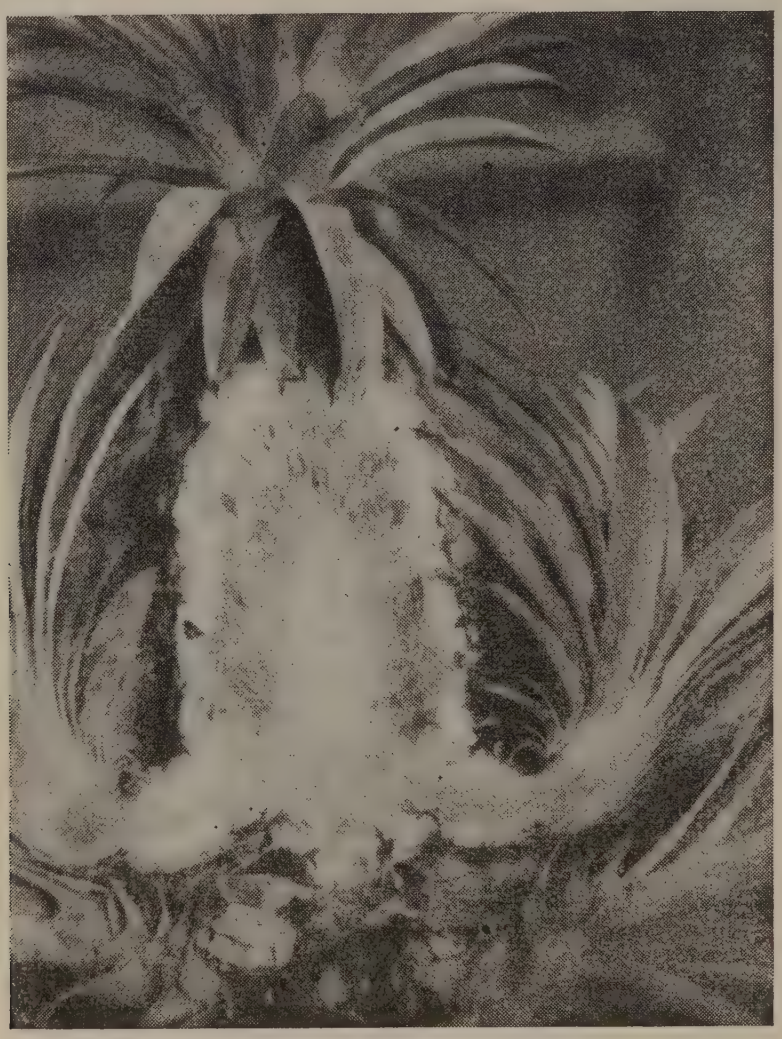


Plate 5.

Collar-of-Slips. A section through a fruit, showing slips arising from the base.

collar plants are often indistinguishable until the fruit has been picked. The near-collar plant could be confused with a vigorously growing, good-type plant with more than the usual number of slips, but there is a difference. In the collar-of-slips type, the slips are so close to the base of the fruit that they break through the bracts at the base of the fruit, whereas in a vigorous plant of the normal type they are attached to the stem below the bracts.

Under adverse conditions, or in a winter crop, the number of slips is normally low and undesirable plant types may escape detection. Hence, it is desirable that selection be done in a summer plant crop. In any case, it would be as well to regard as suspect:—

(1) Plants bearing slips close to the base of the fruit.

(2) Plants bearing slips in the main winter crop.

(3) Plants bearing an excessive number of slips under any circumstances (say, more than three in an average summer crop).



Plate 6.

Near Collar-of-Slips. A section showing slips arising near the base of the fruit.

Long Tom.—The long-Tom is distinguished by its length and the small diameter of the fruit, which is usually knobby at the base (Plate 7). It matures late and sucker growth is so slow that the period between the plant and first ratoon crops may be as long as 2½ years. When growing conditions are very favourable the fruit may be of good size, but usually even the best plants produce inferior fruit. The long-Tom produces slips very freely, hence it can multiply rapidly. However, the type is so easily recognised that it can be eliminated from the stock in a short space of time.

Dry Fruit and Bottle-Neck.—The dry-fruit and bottle-neck plant types are very similar and typical fruits can often be found on plants derived from the same parent (Plate 8). In the dry-fruit type the fruit is small, flowers are absent, and the fruitlets do not develop. In the bottle-neck, the lower fruitlets develop but the upper ones do not; the upper portion of the fruit has, therefore, much the same appearance as a dry-fruit. This irregular development of the fruitlets causes a constriction of the upper portion of the fruit, giving it the appearance of a bottle-neck.



Plate 7.

Long Tom. An undesirable fruit type with an elongated fruit carrying knobs at the base.

In both cases the plants are vigorous and produce slips and suckers quite freely. Since the character is inherited, the progeny are identical with the parent.

Basis of Pineapple Plant Selection.

Improvement in plant type can be achieved in two steps—firstly, the elimination of known undesirable strains; and secondly, the isolation and multiplication of superior strains. Some of the most undesirable



Plate 8.

Dry and Bottle-neck Fruits. These two off-types should be rogued from the plantation.

types tend to multiply more rapidly than the better types, and rapid deterioration will take place in successive plantings if they are not eliminated. Hence, the simplest and quickest method of improving the stock is that of mass selection.

Mass selection is well within the capabilities and facilities of the farmer and entails only a limited amount of time and patience, which

will be well rewarded. The isolation and multiplication of superior true-breeding types, on the other hand, cannot be conveniently handled on a commercial plantation. It involves the selection of single plants and their multiplication by special techniques; the method is normally used only by plant breeders.

Mass Selection Methods.

Defects in plant type may be masked by lack of vigour; hence selection should be practised on a vigorous plant summer crop, when good and bad characters are most clearly expressed. Selection should commence about a month before the fruit reaches maturity so that the fruit can be used in assessing the desirability or otherwise of the plant type (Plate 9).



Plate 9.

Normal Slip Position in Plants of Good Type.

In mass selection, any part of a selected parent plant which will be used for planting material must be marked so that it can be identified later on. This can most easily be done by daubing the tops, slips and suckers with paint. To save time and paint, a preliminary assessment of the area to be selected is made to determine the relative proportions of good and bad types. If the former predominate, the reject plants may be marked, and *vice versa.*

A cheap grade of ordinary house paint of any colour may be used for marking the plant. Orange has been found very suitable, as it is distinctive against a green background. It is applied with a brush

or a wad of cloth tied to a stick. If reject plants are being marked, no special precautions are necessary in the application of the paint, since the planting material is to be destroyed in any case. If, on the other hand, desirable plants are being marked, paint should be used sparingly to avoid its running into the growing point of the plants or planting material.

As the crop is usually allowed to ratoon, there is no need to destroy undesirable parent plants immediately. However, the slips should be removed as soon as practicable, as they are only an unnecessary drain on the plant reserves through the winter.

As the fruit is harvested, the selected tops should be reserved for the current autumn planting. The slips on selected plants may be left on the parent fruit stalk until required for planting in spring.

SELECTION OF LAND FOR PINEAPPLES.

The selection of land for the pineapple crop is based on at least four important factors—elevation, aspect, soils and drainage. The first two are particularly important in southern Queensland, where the climate is subtropical.

Elevation and Aspect.

The pineapple is susceptible to cold conditions, and in southern Queensland growth virtually ceases from early June to late July. Increase in altitude, with its accompanying reduction in temperature, is reflected in the seasonal behaviour of the crop. A noticeable difference in growth and fruiting is apparent at altitudes above about 850 ft. At greater elevations, cropping is delayed and the plants receive a major setback in abnormally cold seasons.

Although the average temperature at lower elevations is more suited to the pineapple, there is a frost hazard in some areas. Here local knowledge of the frost history in any given area is the best indication of its suitability for the crop, since there are many indeterminable factors which influence the incidence of frost. If, by any chance, the crop must be planted on land bordering the frost zone, careful attention should be paid to air drainage, as obstacles which impede the downward flow of cold air from the cultivated area tend to increase the frost risk.

In southern Queensland, pineapples are mostly grown on hillsides to escape frost and it is here that aspect becomes important. The most suitable aspects are from east to north, since they receive the maximum amount of sunlight and are therefore the warmest. Westerly and southerly aspects, particularly the latter, are much colder. The topography of southern Queensland is usually broken and only rarely has all of the cultivable land on a farm an east to north aspect. If at all practicable, however, at least 60 per cent. of the pineapple land should face east to north.

Crops grown on less favourable aspects will mature their crops 2-6 weeks later. In some cases, aspect may be exploited to spread the harvesting period, as, for example, where there is limited labour available.

Soils.

The first requirement of a pineapple soil is that it should be well-drained. A deep, well-drained loam, amply supplied with organic matter and having a friable subsoil, is most suitable, but in practice pineapples are grown on a wide range of soil types. In southern Queensland, the alluvial soils are seldom used because the land is subject to severe frosts.

Drainage.—Soil drainage is determined more by the structure of the subsoil than that of the surface soil. For instance, some of the sandy soils have an almost impervious subsoil which is responsible for waterlogging in wet seasons. The topography of the land, as well as the presence of shelving rock or clay at shallow depths, may cause localised waterlogging on otherwise well-drained soils of good texture. Unless a soil is friable to a depth of about two feet, it will usually be necessary to make some provision for subsurface drainage.

Acidity.—Pineapples are adapted to acid soils and it is usually considered that the optimum pH range for plants is between 4.5 and 5.0. On some soil types the application of sulphur is beneficial. As, however, excessive acidity is frequently associated with poor soil structure, the use of sulphur is generally undesirable. Since the continued application of such artificial fertilizers as sulphate of ammonia increases soil acidity, land cropped with pineapples automatically becomes more acid from year to year.

Organic Matter.—The amounts of organic matter and its decomposition products in a soil play an important part in determining its texture, structure, moisture-holding capacity and fertility. Most of the soils in the coastal belt are notably poor in organic matter. Their condition can be improved by the addition of decaying vegetable material from old pineapple crops or from intercycle green manures.

Soils of Pineapple-growing Areas in Queensland.

In Queensland, pineapples are grown on a wide range of soils, which include sands, sandy loams, basaltic red loams, red loams, clay loams, gravelly loams, and gravelly clay loams. Each has its own problems and requires some degree of special treatment if the best results are to be obtained.



Plate 10.

A Pineapple Plantation in the Woombye District. The soil is a brown sandy loam with a porous subsoil and therefore relatively well drained.

In the area from *Caboolture to Beerwah,* the soils are mostly sands and sandy loams with a reddish-brown subsoil. They are all low in plant foods and organic matter and deficiencies of zinc and copper are common. Some of the sandy soils in this area have an impervious subsoil, which leads to waterlogging in wet seasons unless the natural drainage is improved.

The soils of the *Nambour-Woombye-Palmwoods* area fall into two main groups. The better type, which is characteristic of the Woombye district, is a dark-brown to red-brown sandy loam with a reddish subsoil which allows free drainage (Plate 10). The other group comprises the shallower grey-brown soils, overlying yellow subsoils, which are generally not so well drained. Both are low in plant foods and organic matter, but generally speaking, the reds are superior in this respect to the grey-brown soils.

The soils of the *Blackall Range* and *Buderim* are red loams of basaltic origin which usually have been badly eroded and severely leached; they are difficult soils to manage.

In the *Gympie* district the soils are mainly red loams and clay loams which are generally fairly fertile. The red loams derived from quartzite are rich in manganese, which interferes with iron availability, and consequently iron deficiency symptoms are quite common.

The *Nikenbah-Dundowran* soils are greyish-white, gravelly clay loams overlying a greyish-yellow clay (Plate 11). They are lacking in structure and are extremely poorly drained. In the virgin state they usually produce good crops, but replant crops are less satisfactory.

In the *Yeppoon* area, near Rockhampton, the soils are mostly red-brown loams, similar to those of the Mary Valley, near Gympie, and are



Plate 11.

Plantation at Nikenbah. The soil is a somewhat shallow and stony clay loam.

derived from the same series of quartzite parent rock. Like them, they are manganiferous, generally well drained and tolerably well supplied with plant nutrients.

At *Bowen* and *Ayr*, the soils are alluvial, dark-grey sandy loams and lighter-coloured sands, well supplied with potash but low in nitrogen. Since they overlie gravels, they are mostly well drained and can be irrigated fairly easily from the ample supplies of underground water which are present at shallow depths.

The *Magnetic Island* soils are coarse to gravelly sands of granitic origin. They are extremely well drained but are poorly supplied with nutrients, particularly nitrogen.

In the *Innisfail* and *Cairns* districts, pineapples are grown mainly on deep, red-brown basaltic loams and lighter sandy soils. The former, especially, are reasonably well drained and moderately fertile.

PREPARATION OF LAND.

On account of the shallow nature of the pineapple root system, excessive cultivation of the crop is normally undesirable because of the risk of root injury. Consequently the land should be well prepared before planting, as the cropping cycle occupies up to five years. An exception to this rule is possible in the case of virgin scrub lands, where the initial planting may be made in untilled land, following a scrub burn.

Preparation for Planting.

The land should be brought into a good state of tilth, but a fine seedbed tilth is not necessary for pineapples; a slightly rough surface is, if anything, an advantage. It should, however, be well cultivated to destroy as many weeds as possible, in view of the desirability of avoiding excessive tillage after planting.

For spring planting, land which has been under grass should be ploughed and cultivated between June and September. In the case of replant land which has been under a winter green manure, the latter should be ploughed under before the end of the winter so that cultivation can be completed before the end of September, when planting would commence.

For autumn planting, land preparation should be completed by the end of February to allow planting in early March. If the land has been under a summer green crop, this should be ploughed under in sufficient time to allow for the final preparation of the land by the end of February.

LAYOUT OF THE PLANTATION.

In laying out a plantation, provision has to be made for access roads to facilitate cultural operations and harvesting, and for drainage channels to dispose of surface runoff and minimise soil erosion.

When the crop is harvested by hand, it is neither convenient nor economical to carry fruit more than 1½-2 chains along the rows, hence roadways intersecting the rows should be spaced not more than four chains apart. This determines the length of rows and may also influence the location of surface drains provided to carry the runoff from the rows.

Surface Drainage.

The first consideration is to divert from the cultivated areas all runoff water from adjacent land. This necessitates the construction of a main diversion drain immediately above the field and leading to the

nearest natural water channel. A drain at least 18-24 in. wide and 12 in. deep, with a fall of 1-2%, is necessary. This allows a free flow of water without any undue loss of soil.

There are two surface drainage systems in use—cross-sectional and contour drainage. The former has been practised for many years in southern Queensland and meets the requirement of providing free surface drainage, but inevitably results in some loss of soil. The application of contouring methods reduces soil losses, but in certain soils may permit greater intake of water into the soil. In extreme cases subsurface drainage may be necessary.



Plate 12.

Contour Planting in an Established Plantation. The grassed waterway in the mid-foreground collects surface water from the rows and delivers it safely at the bottom of the slope.

Cross-Sectional Drains.—Cross-sectional drains consist of interception drains at intervals of not more than 45 ft., running across the slope, with a fall of 5 ft. per chain (about 7%) capable of carrying away runoff from the intervening cropped areas. Between drains, the rows may run directly down the slope or at an angle to it, in a herringbone pattern. In setting out the rows, provision is also made for small, inter-row drains to eliminate wash across the rows, which is conducive to erosion and detrimental to the plants.

Contouring.—Contour drains are placed at much the same intervals as cross-sectional drains, but their fall is limited to 2% so that the flow is reduced to non-erosive velocities (Plate 12). Since they follow the contour of the land they will not necessarily be parallel, their distance apart varying along their length according to the slope of the land at any point.

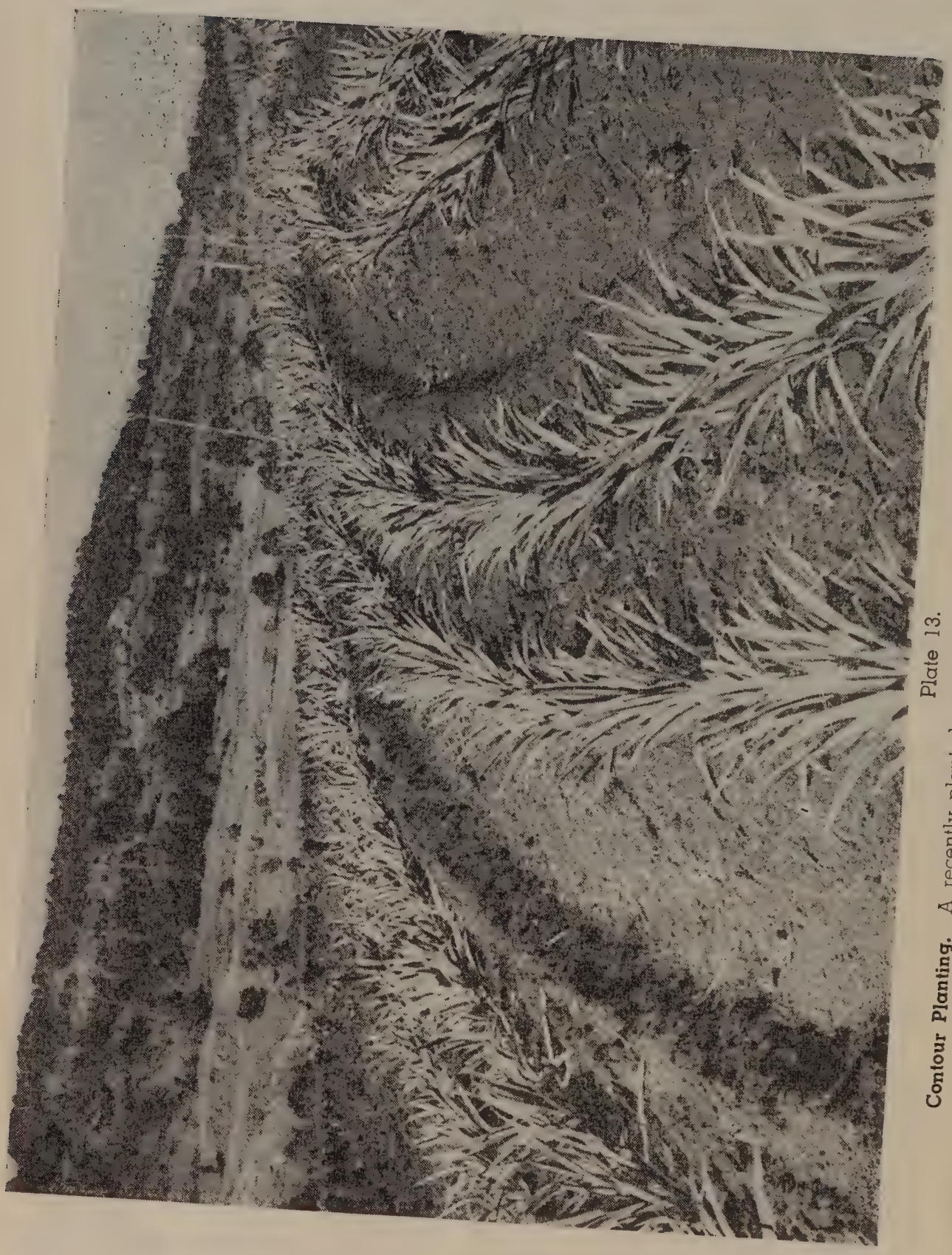


Plate 13.

Contour Planting. A recently planted area on a steep slope in the North Coast district. Note the drain between each pair of rows.

In contour-drained areas, planting follows the contour and it is also essential here to provide inter-row drains between adjacent rows (Plate 13). These would be given a fall of 2-4%, depending on soil type and the length of the rows. Inter-row drains may be set out parallel to the main drain above, leaving a number of short-point rows immediately above the lower drain. As there is a tendency for soil to accumulate on the upper side of the rows and to move away from the lower side, the planting rows should be closer to the upper inter-row drain.

PLANTING MATERIAL.

Pineapples may be propagated by any one of four types of planting material—tops, slips, suckers and butts. Provided they are of good type and are properly handled, all give good results. The time taken to produce a crop varies with the planting material. Under optimum conditions, slips and suckers will crop in about 18 months in southern Queensland, whereas tops and butts take about two years. In North Queensland growth is faster and there is not the same difference between tops and slips or suckers; all will fruit in 12-18 months as a general rule.

With any given type of planting material, the period from planting to harvesting depends on the size of the material planted. For instance, it may take small slips as much as six months longer to produce a crop, particularly in southern Queensland. For this reason, planting material should be graded before planting, otherwise the stand will be uneven.

Tops.

Tops are excellent planting material, and being usually of much the same age and size, produce a very uniform stand.

After the tops are removed from the fruit at harvesting they should be stripped and stacked to dry the cut ends. Stripping entails the removal of the small basal leaves so that about $\frac{1}{4}$ in. of the butt is exposed. This should be done promptly, for the fresher the material, the easier it is to strip the leaves. The stripped tops should then be spread out, base uppermost, in a single layer in the open. On no account should they be heaped in the shade, where they are liable to rot very quickly. Prepared tops should be allowed to dry for at least 24 hours before being planted, but they can be left for longer periods if desired.

Alternatively, tops may be removed in the field as the fruit is being harvested, and placed, base uppermost, on top of the plants. They dry quickly, but stripping before planting is more difficult than in the previous case.

Summer tops are large and fit in well with the normal cropping schedule in southern Queensland. Winter tops are less satisfactory but may be used in an emergency when better planting material is not available. In North Queensland, winter tops are only slightly smaller than summer tops and are consequently quite good planting material.

Slips.

Slips are available in quantity only from a summer crop. When the fruit is harvested they are relatively small and it is usual to leave them on the parent plant until a few days before they are required for planting. During this period they grow at the expense of the parent plant and its ratoon crop, but this is normally justified by the need for good material in a new planting.



Plate 14.

Vigour in Slips. Left, plants not selected for vigour. Right, plants selected for vigour.

As the slips are pulled, the small pinelet at the base should be snapped or cut, not screwed, off and the slips collected and stacked, base uppermost, in a single layer to dry. Stripping of the basal leaves promotes early establishment of a root system after planting.

When they are being stacked to dry, slips should be graded for size (Plate 14). This will materially assist in producing uniform stands in the field.



Plate 15.

Trimmed Suckers. Suckers may be trimmed if they are to be sent by rail or truck for long distances.

Suckers.

Suckers vary more in age and size than do either tops or slips and growth is somewhat uneven after planting. Before being planted, the tight basal leaves may be peeled off to expose the young roots and so facilitate early root establishment. They should be stacked to dry the ends before planting.

Very large suckers, or suckers which are to be transported long distances, may be lightly trimmed (Plate 15). This can be done by gathering the leaves in one hand and cutting straight across with a large knife at least 15 in. from the base. In no case should they be severely trimmed, and trimming should be practised only when it is absolutely necessary. Very large suckers may fruit prematurely soon after they are planted. The fruit so produced is invariably small and

useless; it should be broken off and the plant allowed to sucker again. It is for this reason that emphasis is placed on the desirability of grading suckers before planting.

Butts.

A butt is the stem of a plant and the term is usually applied to a mature plant which has already borne a fruit. The older the butt the less satisfactory it is for planting material on account of the depletion of its food reserves (Plate 16).



Plate 16.

Butts. The pineapple stand established from butts is usually uneven. Left, backward plants from butts. Right, forward plants.

In preparing a butt for planting, the old rooted portion is usually cut off to reduce the bulk of the planting piece. The leaves should be trimmed back close to the stem to allow better contact with the soil and to facilitate the production of new roots. After trimming in this way, butts should be allowed to dry for several days to seal off the cut surfaces.

[TO BE CONTINUED.]

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Legislation for the Control of Bunchy Top in Bananas.

F. COLBORNE, Secretary, Banana Industry Protection Board.

IN Queensland, the production of bananas is seriously handicapped by pests and diseases. As a consequence, legislative controls over the crop are very far-reaching.

HISTORICAL.

The original Diseases in Plants Act was passed in 1896. At that time, and indeed up to 1921, there had been no need for legislation specifically relating to the banana industry; all requirements could be met by the general provisions of the Act. However, about the year 1913, the disease known as bunchy top (Plates 1 and 2) was introduced into northern New South Wales, probably by infected suckers from Fiji, and it soon spread to southern Queensland. The significance of the disease was scarcely appreciated until about 1922. Plantation

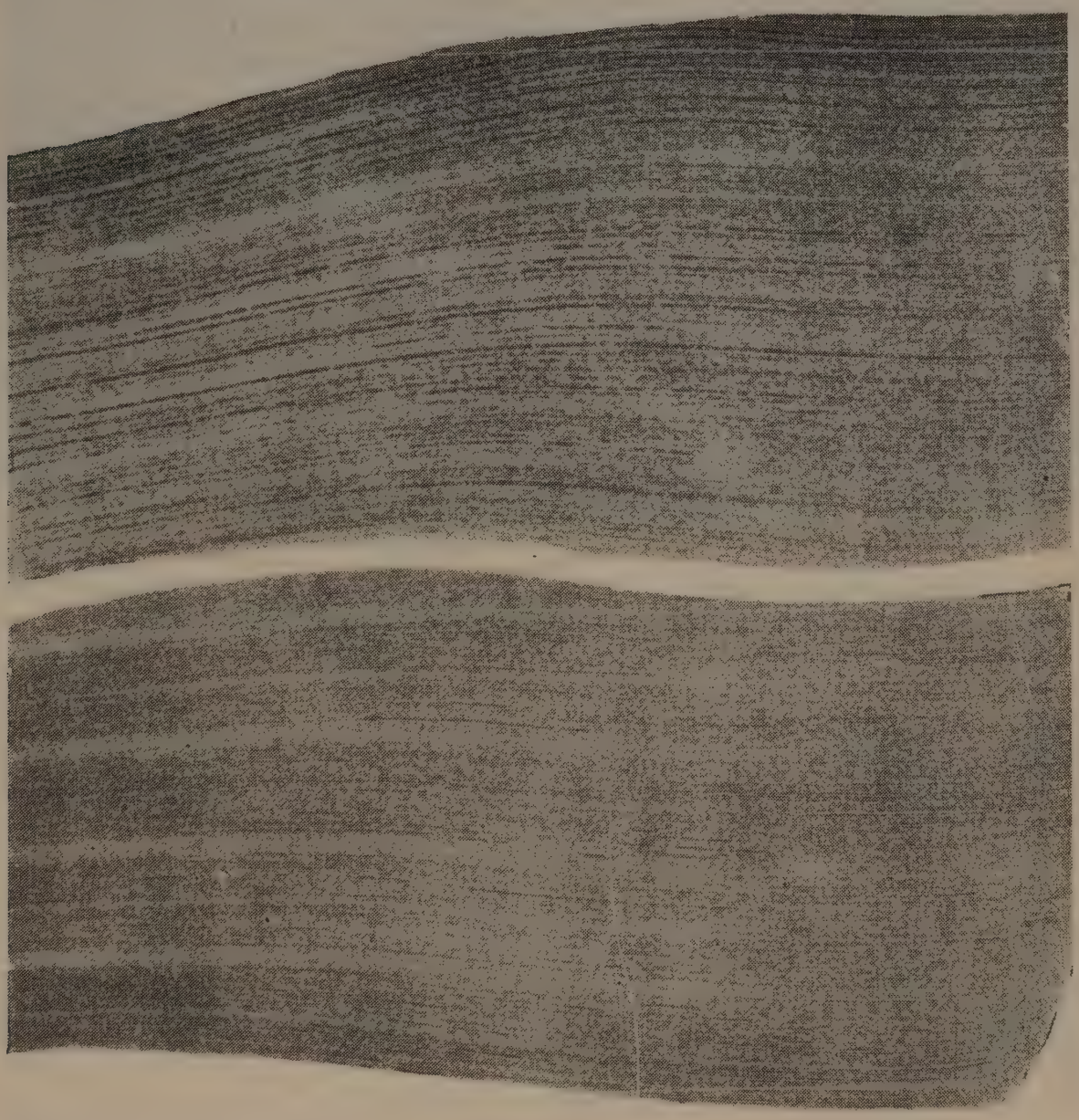


Plate 1.

Bunchy Top of Banana. The upper leaf portion shows the characteristic dark dots, dashes and lines of an infected plant. The leaf portion below it is from a normal plant.

failures then assumed serious proportions and an industry which at that time was worth more than £1,000,000 in Queensland alone was virtually faced with extinction.

In May, 1924, the Commonwealth, New South Wales and Queensland Governments appointed a Committee to investigate the disease. A few years later, Dr. C. J. Magee, who carried out investigations on behalf of the Committee, demonstrated that bunchy top was caused by a virus which is transmitted from diseased plants to healthy plants by the banana aphid. As a corollary, any hope of a cure for infected plants disappeared.

On completing its investigations, the Committee recommended to the States concerned that certain control measures should be adopted. These control measures had two main features, namely—

(1) *Restrictions on the movement of planting material.*—The rapid distribution of the disease after its original introduction into Australia was largely caused by the movement of infected planting material. The use of planting material from sources which are known to be free from disease is, therefore, a prerequisite of any control programme.

(2) *The destruction of diseased plants as soon as symptoms can be detected.*—If this is done thoroughly, plantations in which the disease has appeared can be kept in production in spite of the occasional loss of an infected stool. On the other hand, failure to eradicate diseased plants is invariably followed by the distribution of infected aphids and fresh outbreaks within the plantation. Considerable skill and experience in the field are required to recognise bunchy top in the early stages, but most growers, with practice, can become adept at detecting the disease. Thorough inspection at regular intervals is essential in commercial plantation management.

THE DISEASES IN PLANTS ACTS.

In the early 1920's, the disease was confined to an area between the New South Wales border and the Maroochy River. Many of the plantations in which it had appeared were then abandoned and these provided a reservoir from which bunchy top could spread. In order to cope with this problem, the Diseases in Plants Act was amended in 1929. A neglected or abandoned plantation was defined and the Minister was authorised to approve the destruction of banana plants if, in the opinion of an Inspector, the plantation was a potential menace to other growers, owing to its liability to harbour or spread a disease or pest.

In 1930, a proclamation under the amending Act prohibited the removal of banana plants except under the authority of a permit issued by an Inspector. This proclamation also prohibited the removal of banana plants from that part of the State which lies south of the northern boundary of the Parishes of Maroochy and Maleny to any other part of the State.

This isolation of the southern part of the State as a protective measure against the spread of bunchy top was strengthened in 1934 by the further proclamation of a Quarantine Area between the Maroochy River on the north and the Maroochy-Landsborough-Caloundra roads on the south. The boundaries of this area have since been altered and it

is now situated between the Noosa River on the north and the Maroochy River on the south. The removal of banana planting material out of this area is prohibited, thereby creating a buffer between the southern portion of the State, where bunchy top occurs, and the northern areas, where the disease is absent.

In 1933, a further proclamation was gazetted, requiring the owner of a banana plantation to destroy immediately any plants showing symptoms of bunchy top. The following method of treatment was prescribed:—pour half a pint of kerosene into the throat of the plant and allow it to trickle down over the pseudostem and attached leaf bases (killing any aphids present); completely dig out and chop up

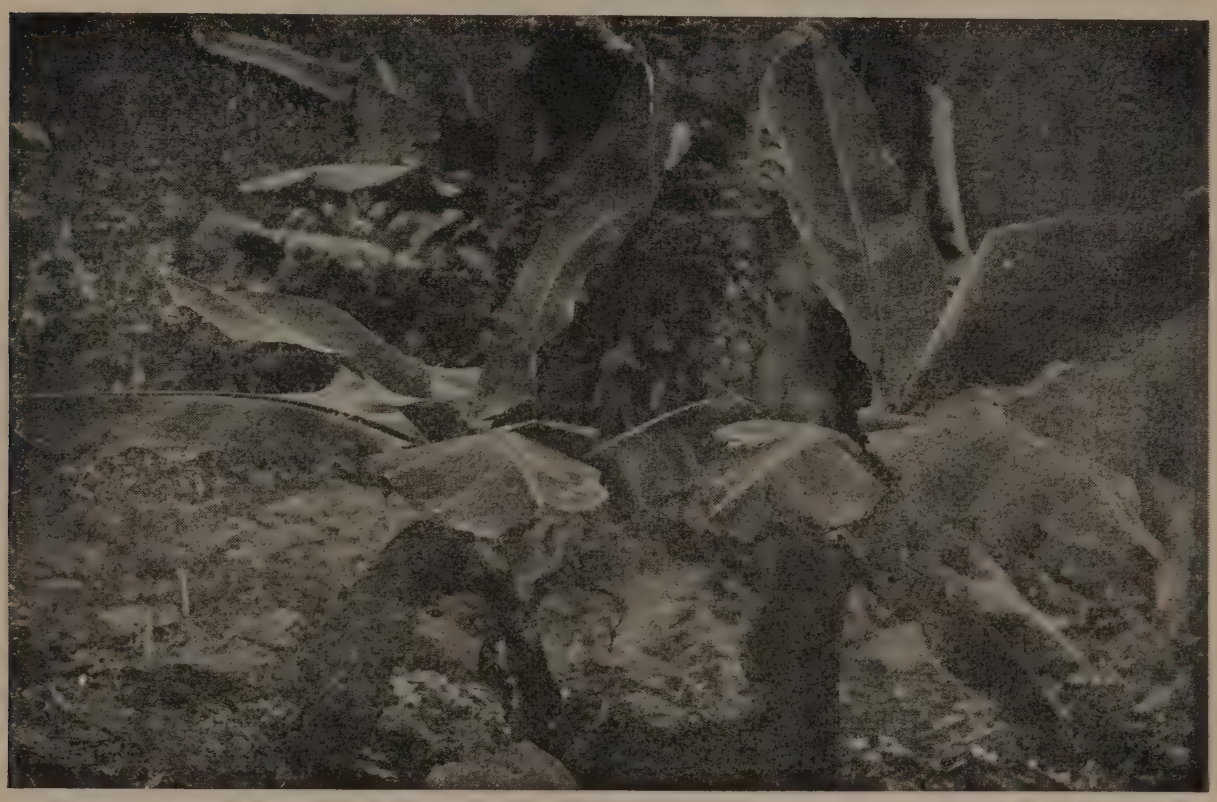


Plate 2.

Banana Plants showing the Symptoms of a Fairly Recent Infection with Bunchy Top. Note the dipping back of the blades from the midrib in the younger leaves and the incurved and wavy condition of the margin.

the infected stool, including the attached plants and suckers. This method of destroying infected plants is an essential part of the bunchy top control programme. The work presumes, of course, that the grower can recognise the disease and appreciates the threat which it is to his own interests. In plantations where the disease has occurred, it involves weekly plant-to-plant checks through the area; nothing less will suffice.

THE BANANA INDUSTRY PROTECTION ACTS.

The original Banana Industry Protection Act was passed in 1929 with the object of making better provision for the protection of the banana industry. It brought into existence the Banana Industry Protection Board, with special responsibilities for improving and developing the industry.

In addition to advising the Minister on matters of policy, the Board meets regularly to discuss administrative problems arising from the operation of the Banana Industry Protection Act. It therefore deals with such matters as the eradication of abandoned or neglected banana

plantations, banana quarantines, the issue of planting permits and the traffic in banana planting material. The Board's Agents are stationed in all centres where bananas are an important horticultural crop. They are responsible for implementing those sections of the Diseases in Plants Acts which affect the banana grower.

The Banana Industry Protection Acts are complementary to the Diseases in Plants Acts. Each year the Board draws up a planting policy for the Minister's approval. The planting policy sets out the requirements of the Banana Industry Protection Acts and the Diseases in Plants Acts and also the obligations of the grower and of the supplier of the banana planting material.

SUMMARY OF THE LEGISLATION.

When a grower wishes to establish a new plantation or to extend an existing plantation, he must submit an application to the local Agent of the Banana Industry Protection Board indicating the area to be planted and the proposed source of planting material. If the Board approves the application, the grower will be issued with the necessary authority to remove planting material to his own plantation from the source of supply. The Board's decision will, in all cases, be governed by the legislation in force at the time.

Among other things, the legislation prescribes when plantings may be made, the grade standards for planting material, permissible sources of planting material and standards of plantation management. It also requires the eradication of old plantations which are no longer commercially profitable. The main features of the existing legislation may be summarised as follows.

Time of Planting.

In Southern Queensland, bananas may be planted only during the period between August 1 and January 31 in the following year. Plantings after January 31 are seldom a commercial success in this area and tend to become neglected.

Grade Standards for Planting Material.

Planting material usually consists of either suckers or bits. A saleable sucker is an offshoot from a corm which is not less than 12 months old; it must be not less than three inches in diameter at its thickest point. A saleable bit is a portion of a mature corm with a well-developed, undamaged "eye" above the surface of the corm; the bit should be at least 4 in. x 3 in. x 3 in. in size, with the eye centrally placed on one side.

Permitted Sources of Planting Material.

The permitted sources of planting material have been defined for a new plantation, an extension of an existing plantation and the quarantine area on the North Coast. Details are as follows:—

For a New Plantation:—

(*a*) Planting material may be obtained only from a plantation which has been approved by the Board. The Board's approval is governed by the incidence of bunchy top in any particular district. In districts where the disease does not occur, approval is formal. In districts where the disease has been recorded, however, the Board will only approve a plantation as a source of planting material when it has been

free from bunchy top for a specified period and plantation management has been efficient. Current requirements in the quarantine area and in the inspectional districts of Caboolture and Brisbane are given below; in other districts where bunchy top has been recorded, plantations are normally only approved as sources of planting material when they have been free from the disease for a period of not less than six months.

(*b*) Planting material may be removed from a plantation where thrips or beetle borer is prevalent only when it is not available from a clean area. Such material must be in the form of pared suckers or bits.

(*c*) Planting material may not be removed from one Banana Agent's district to that of another Agent except with the prior approval of the Banana Industry Protection Board. The Board may approve such an application if suitable material is not available locally.

For an Extension of an Existing Plantation:—

Planting material from an existing plantation may be used for an extension of that plantation, if—

(*a*) the existing plantation is well cared for and pests and diseases are being satisfactorily controlled;

(*b*) the proposed extension of the plantation is not in close proximity to another plantation which is infected with bunchy top and a potential source of infection for the new area.

Within the Quarantine Area and the Inspection Districts of Caboolture and Brisbane:—

The Quarantine Area for bunchy top is situated on the North Coast, the northern boundary being a line approximately west of the mouth of the Noosa River and the southern boundary line approximately west of the mouth of the Maroochy River. Within this area, planting material for both a new plantation and an extension of an existing plantation must come from a well-managed plantation which has been free from bunchy top for at least the preceding 12 months.

The same conditions apply in the Inspectional Districts of Brisbane and Caboolture.

STANDARDS OF PLANTATION MANAGEMENT.

When plantation management is inefficient, control measures for bunchy top are usually not applied thoroughly. There are several criteria of inefficient management, chief among which are the following:—

(*a*) The presence of weed growth in such quantities that the grower is unable to patrol the plantation with ease and readily detect abnormal plant behaviour.

(*b*) Failure to remove surplus sucker growth which not only impoverishes the parent plant but also indicates a lack of any desire by the grower to produce a commercial crop for the longest possible period.

(*c*) The absence of vigorous plant growth.

The inefficient and negligent grower is mainly responsible for serious outbreaks of bunchy top and its persistence in areas where the disease has been recorded. The Banana Industry Protection Board therefore

insists that growers shall comply with the normal requirements of efficient plantation management, and the penal clauses in the Diseases in Plants Acts are enforced whenever necessary to safeguard the interests of the industry as a whole. The Board expects growers to locate bunchy top in their plantations, to destroy any infected plants in the manner prescribed and to report outbreaks to its Agents. If they do this, the work of the Board's Agents will be considerably simplified.

Eradication of the Plantation.

When a banana plantation ceases to be commercially useful, it must be totally eradicated. In the early days of the banana industry, production was somewhat speculative, plantations being established and later abandoned when the returns from the fruit did not cover the expenses incurred in maintaining them. No attempt was made to dig out and destroy the plants unless the land was required for other purposes. As bananas were planted in hilly and often inaccessible country, the remains of old plantations persisted for many years among a dense mass of weeds and saplings before they were eradicated. Such plantations were a major source of concern to the Board when control measures for bunchy top were first brought into operation, and the fact of their existence lengthened the period required to get the industry back on to a sound footing after the bunchy top disaster of the 1920's.

It is, therefore, now an obligation of the occupier (the person growing the crop) to eradicate an old banana plantation. If the occupier fails to comply with this provision of the Acts and, for any reason, legal proceedings cannot be taken against him, the responsiblity for eradicating the area falls on the owner of the land. In order to protect the interests of both the owner and the lessee of land on which bananas are to be grown, the lease should be properly drawn up and executed. In many such leases now in force, it is stipulated that a proportion of the rent shall be repayable to the lessee at the expiry of the lease, provided the bananas on the leased area have been eradicated to the satisfaction of the Board's Agent.

Points to Remember.

The Grower:—

(1) Apply for a planting permit at least four weeks before the proposed planting date.

(2) Patrol the plantation every week during the spring and summer and every fortnight during autumn and winter for bunchy top infected plants or plants showing other abnormalities.

(3) Treat bunchy top plants immediately with kerosene, then dig out the stools, and notify the local Agent of the Board of the outbreak as soon as possible.

(4) Regard plants with abnormal leaves as suspect bunchy top plants until the position has been checked by an Agent of the Board.

The Landholder:—

When leasing land for banana growing, protect your own interests with a properly executed lease in which your responsibility as the lessor and/or that of the lessee, for eradicating the plantation when it is no longer commercially profitable, are clearly defined.

PLANT PROTECTION

Tobacco Pest Control Schedule for the 1953-54 Season.

W. A. SMITH, Entomologist, Science Branch.

FOR some time this Department has been carrying out tests with a large range of materials to find a substitute for lead arsenate sprays in tobacco fields. This pest control schedule introduces on a commercial scale the new insecticide dieldrin, which is highly toxic to the tobacco looper*. The pests with which the present schedule is concerned include looper, budworm,† cluster caterpillar,‡ leaf miner,§ and stem borer,¶ in the seedbed and in the field, and also seed-harvesting ants. Additional measures will be required if root-knot nematode, cutworms or wireworms are likely to be field factors limiting yields.

CONTROL SCHEDULE.

In Seedbeds.

Prepare the seedbed sites early and eliminate as many weeds as possible.

Sterilize the beds and paths before planting. This may be achieved in varying degrees by firing, steaming or fumigating with DD.

Spread a layer of medium grade river sand to a depth of one-eighth of an inch on the beds after planting, as protection against seed-harvesting ants.

Two weeks after germination, or earlier if obviously necessary, commence light weekly spraying with 0·1% DDT. The spray should be directed horizontally from each side of the bed and should be applied after the last watering for the day.

Give the seedlings a thorough spraying with DDT a day before pulling for transfer to the field.

In the Field.

During the first three weeks after transplanting, weekly routine spraying with DDT should be made. A dust may be used but a spray is more effective. **If looper is present use an additional spray of 0·05% dieldrin.**

---

* *Plusia argentifera* Gn.
† *Heliothis armigera* (Hb.).
‡ *Prodenia litura* (F.).
§ *Gnorimoschema operculella* (Zell.).
¶ *Gnorimoschema heliopa* (Low.).

In subsequently relaxing the frequency of spraying, the grower should be guided by his own observations on the presence of young stages of the leaf pests. Fortnightly applications of 0·05% dieldrin may prove sufficient if the spraying is thorough. Complete cover should be the objective—that is, both sides of each leaf should receive a film of insecticide. Since the value of dieldrin in controlling leaf miner, cluster caterpillar and budworm is not known sufficiently well, it may be found necessary to use an occasional DDT spray. If budworm is the only pest operating, the budworm dry bait, restricted to the hearts of the plants, will give the most economical control; alternatively, the tops of the plants may be sprayed rapidly with DDT.

Insecticides and insecticide strengths recommended for use in tobacco fields are as follows:—

(1) *DDT.*—Strength of spray, 0·1%, preferably in the emulsion form; strength of dust, 2%.

(2) *Dieldrin.*—The spray should contain 0·05% active ingredient (for example, dilute a 15% concentrate to 1 in 300).

(3) *Lead Arsenate.*—To prepare budworm dry bait, thoroughly mix 1 lb. lead arsenate with 20 lb. bran, pollard or maize meal.

WARNINGS.

To avoid the risk of undesirable taints and residues, insecticides should be used on tobacco only when necessary. Dieldrin should not be used in excess of the recommended rate, particularly during the week before harvesting.

A health risk is involved if dieldrin is inhaled, ingested or absorbed through the skin. Care should be taken to avoid inhaling this insecticide or being unduly wet by spray. Splashes of the concentrate should be washed off immediately with soap and water and any clothes which are splashed should be changed immediately and not worn again until they have been washed.

VOL. III. OF THE "QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK."

"INSECT PESTS AND DISEASES OF PLANTS."

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The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 369 of the June Issue.*)

Scribbly Gum.

Botanical Name.—Eucalyptus micrantha DC.

Other Common Names.—White gum, sugar gum, cabbage gum.

Distinguishing Features.—This tree (Plates 24-26) has a white, smooth bark marked by numerous scribbly lines.

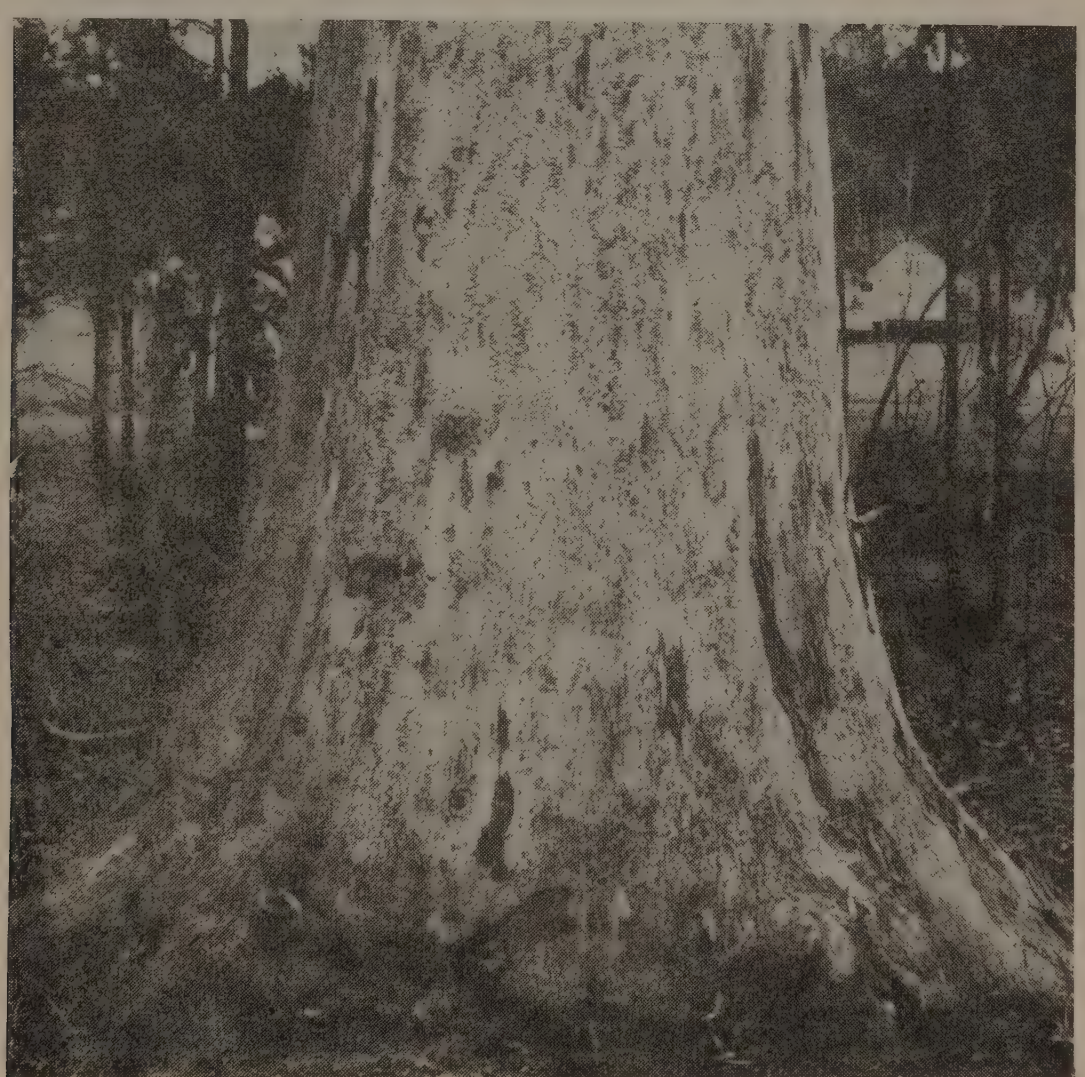


Plate 24.

Scribbly Gum (Eucalyptus micrantha). Portion of trunk. Mount Gravatt.

Description.—A tree up to 80 ft. high with smooth white bark marked by numerous dark wriggly lines like scribble marks. The leaves are curved and shorter on one side than the other at the base, mostly 4-6 in. long and about 4-8 times as long as wide. The flowers are produced in small bunches beside the leaf-stalks and are slightly less than $\frac{1}{4}$ in. wide when fully open. The lid of the bud is very small and rounded. The seed-capsules are nearly hemispherical, about $\frac{1}{4}$ in. wide and a little shorter, with a small opening.

Distribution.—Moreton and Wide Bay Districts, usually on sandy hillsides. It extends northwards to Rockhampton and is also in coastal New South Wales. There are other scribbly gums in New South Wales and they are very difficult to distinguish from one another.

Usual Flowering Time.—July to October.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Nil to minor.



Plate 25.

Scribbly Gum (Eucalyptus micrantha). From left, branchlet with capsules; coppice leaf; branchlet with flower buds.

General Remarks.—It is claimed by many beekeepers that scribbly gum never yields nectar. This belief is due to the limited amount of honey from this species being masked in a natural blend with choicer honeys from more prolific species flowering at the same time. Pure samples are, however, obtained at odd intervals. The tree is useful only as a supporting nectar-producing species amongst the better-class honey flora.

The rather dark honey from scribbly gum is never better than second grade; the flavour is strong, verging on bitter, and the density is weak. It granulates slowly with a coarse brown grain.



Plate 26.

Scribbly Gum (Eucalyptus micrantha). Mount Gravatt.

Flooded Gum.

Botanical Name.—Eucalyptus grandis W. Hill ex Maiden.

Other Common Name.—Rose gum.

Distinguishing Features.—This is a tall, straight tree (Plates 27-28) with smooth white bark except for 6-10 ft. (rarely more) of rough flaky bark at the base and spreading (not drooping) green leaves paler beneath.

Description.—This is often a very tall, straight tree up to 120 ft. or more with about 6-10 ft. (rarely more) of rough flaky bark at the base and smooth white bark on the rest of the tree. The crown is usually rather dense. The leaves are spreading, dark green above and somewhat shining, paler on lower surface, about 4-6 in. long and about 4-6 times as long as wide. The flowers are produced in small bunches on flattened stalks besides the leaf-stalks and are between $\frac{1}{2}$ in. and $\frac{3}{4}$ in. wide when fully out; the lid is conical and somewhat pointed, as long as, and somewhat wider than, the rest of the bud. The seed-capsules are widest near the top and usually gradually taper to the short stalks, about $\frac{1}{4}$ in. long and wide, with the valves slightly projecting and curved inwards.

Distribution.—Wetter places of the coastal belt, often along streams and at the edges of scrub, sometimes on hillsides forming forests with scrub box. It is known from as far north as the Atherton Tableland and is in northern New South Wales.



Plate 27.

Flooded Gum (Eucalyptus grandis). Left, branchlet with leaves and seed-capsules. Right, branchlet with flower buds.

In the past this species was sometimes confused with the Sydney blue gum (*Eucalyptus saligna*). The two trees are often much alike but the latter has a rather narrower lid to the bud and widely spreading valves to the seed-capsule. In Queensland *E. saligna* is known only from the neighbourhood of Pechey and Crow's Nest, where it is called " woolly butt," but it possibly occurs elsewhere on the western slopes of the Main Range.

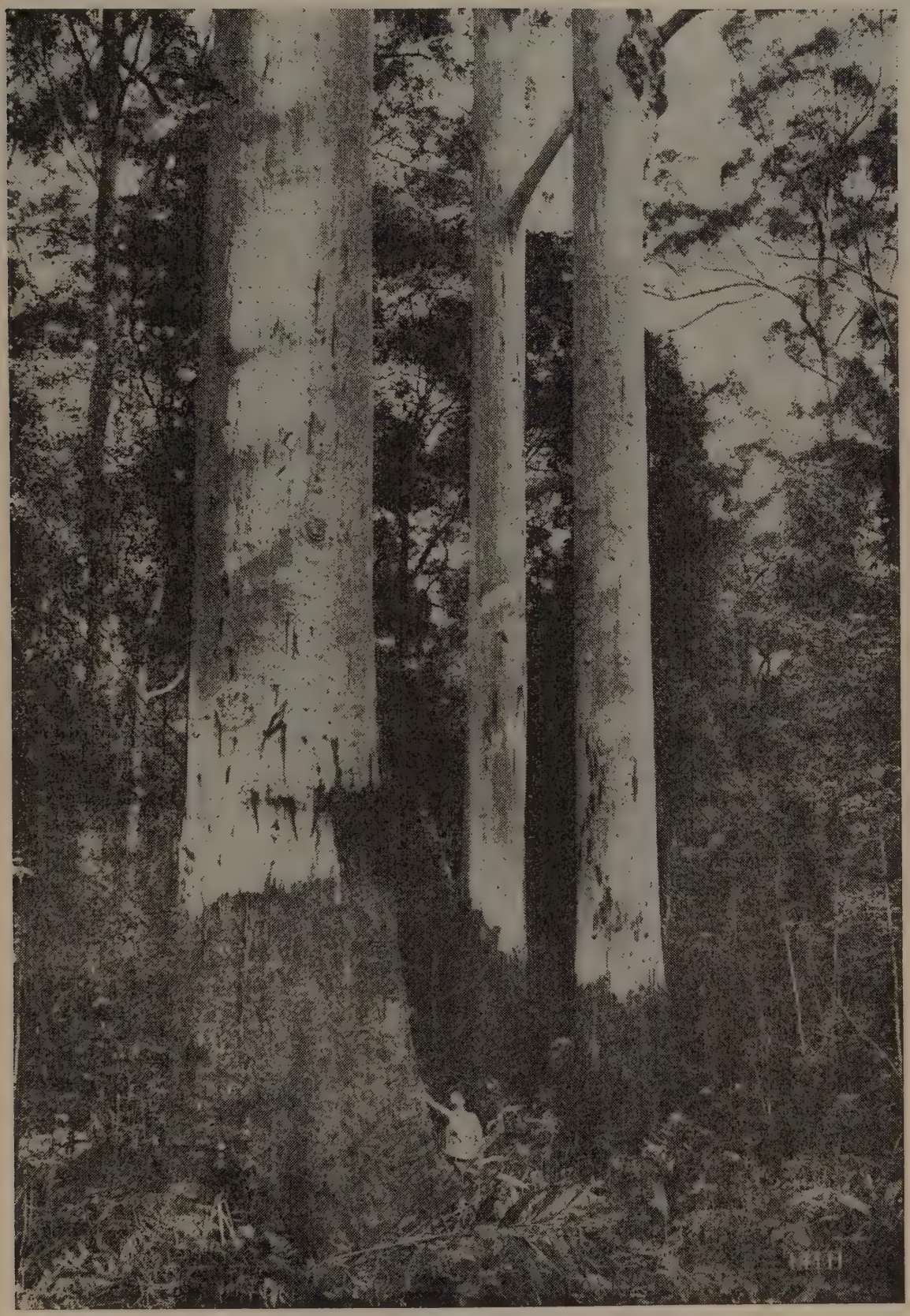


Plate 28.

Flooded Gum (Eucalyptus grandis). Eumundi district.
[*Photograph by Forestry Sub-Department.*

Usual Flowering Time.—March to May.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

General Remarks.—Although this tree blossoms regularly, and at times heavily, it is a shy-yielding species. A small surplus is gathered occasionally, usually in the form of a natural blend with honey from other species flowering at the same time.

Good quantities of pollen are obtained and as a result beekeepers with apiaries in flooded gum localities find that colonies maintain strength during the normally adverse autumn and early winter periods.

The honey is strong, somewhat unpleasant in flavour and of weak density. It granulates fairly quickly, is slaty in colour, and has a soft, smooth grain. In the comb, honey from this tree is much lighter coloured than the subsequently extracted and stored product.



Plate 29.

Moreton Bay Ash (Eucalyptus tessellaris). Left, branchlet with seed-capsules. Right, branchlet with flower buds.

Moreton Bay Ash.

Botanical Name.—Eucalyptus tessellaris F. Muell.

Other Common Name.—Carbeen.

Distinguishing Features.—This is a tree (Plates 29-31) with the bark on the lower part of the trunk dark grey or blackish and neatly cracked into small square or oblong pieces, elsewhere smooth, pale grey or whitish, and with narrow drooping leaves.

Description.—A tree up to 60 ft. or more in height; the bark on the lower or greater part of the trunk is dark grey and neatly cracked into small square or oblong pieces about $\frac{3}{4}$ in. long; the bark on the upper part of the tree is smooth, pale grey or whitish, shed each year, sometimes with darker grey patches before it is shed. The leaves are about 3-6 in. long and 8-15 times as long as wide, on rather short stalks, and hang from the drooping branchlets. The flowers are produced in little bunches along the twigs mixed with the leaves and are nearly $\frac{1}{2}$ in. wide when fully out; the lid on the bud is very short



Plate 30.

Moreton Bay Ash (Eucalyptus tessellaris). Portion of trunk.

and thin. The seed-capsules are either cup-shaped or like an egg with the top cut off, with very thin walls, $\frac{1}{3}$-$\frac{1}{2}$ in. long and $\frac{1}{4}$-$\frac{1}{3}$ in. wide, but they are very fragile and are not often seen.

Distribution.—Widely spread in south-eastern Queensland, chiefly on sandy soils, but the trees are usually scattered. It is found throughout the eastern half of Queensland and in northern inland New South Wales.



Plate 31.
Moreton Bay Ash (Eucalyptus tessellaris). Goodna.

Usual Flowering Time.—November to February.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Nil to minor.

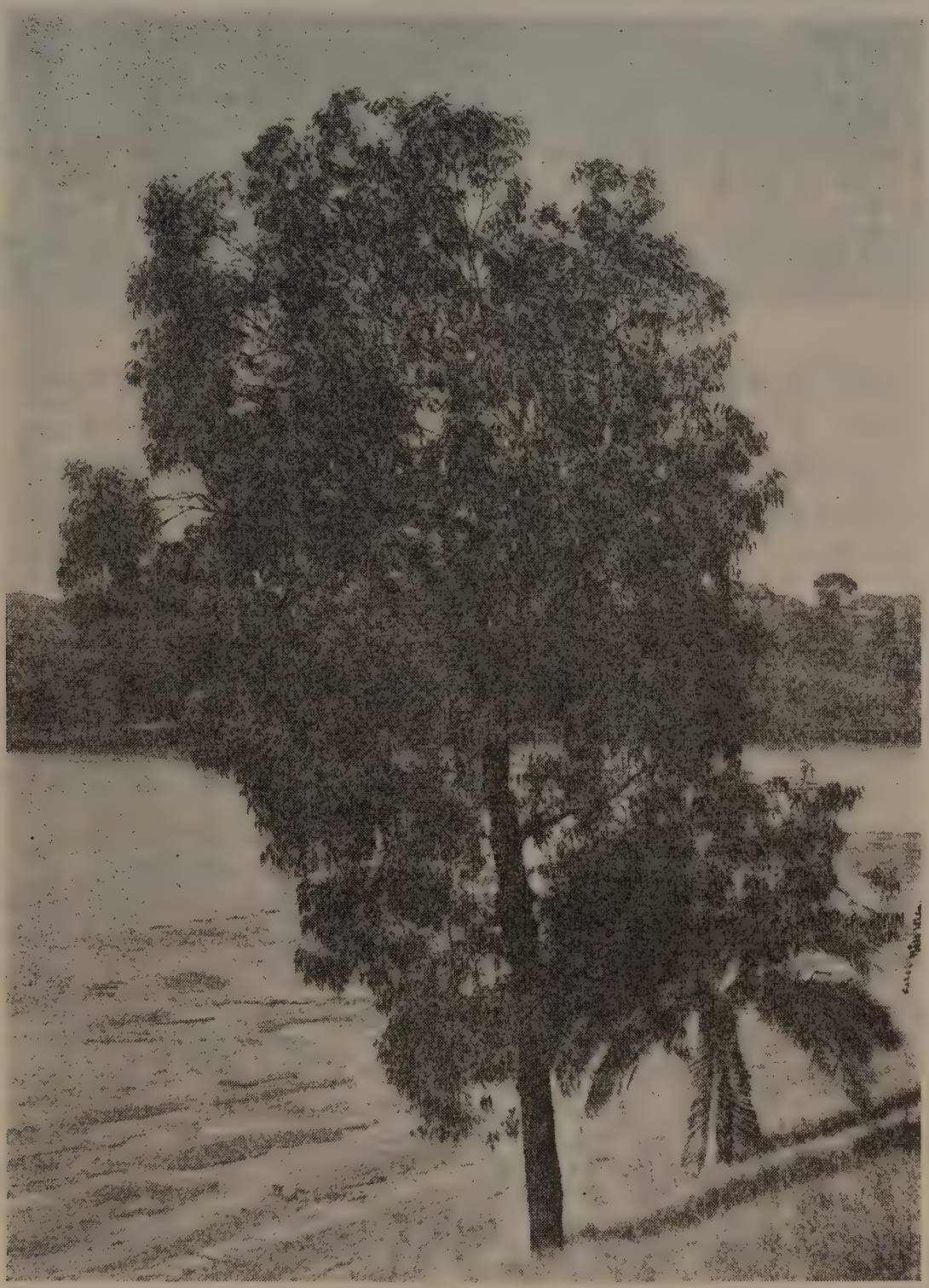
Importance as a Source of Pollen.—Nil to minor.

General Remarks.—Many beekeepers consider that this well-known and widespread species has no value as a nectar- and pollen-producing tree. Nevertheless, there are reliable records indicating that Moreton Bay ash produces a small amount of nectar and pollen in some parts of the Darling Downs, Moreton and Wide Bay Districts. It is, however, never better than a minor supporting species amongst better-class flora.

The weak-bodied honey from this species is mildly acid in flavour. The granulating quantities are unknown.

Correction.

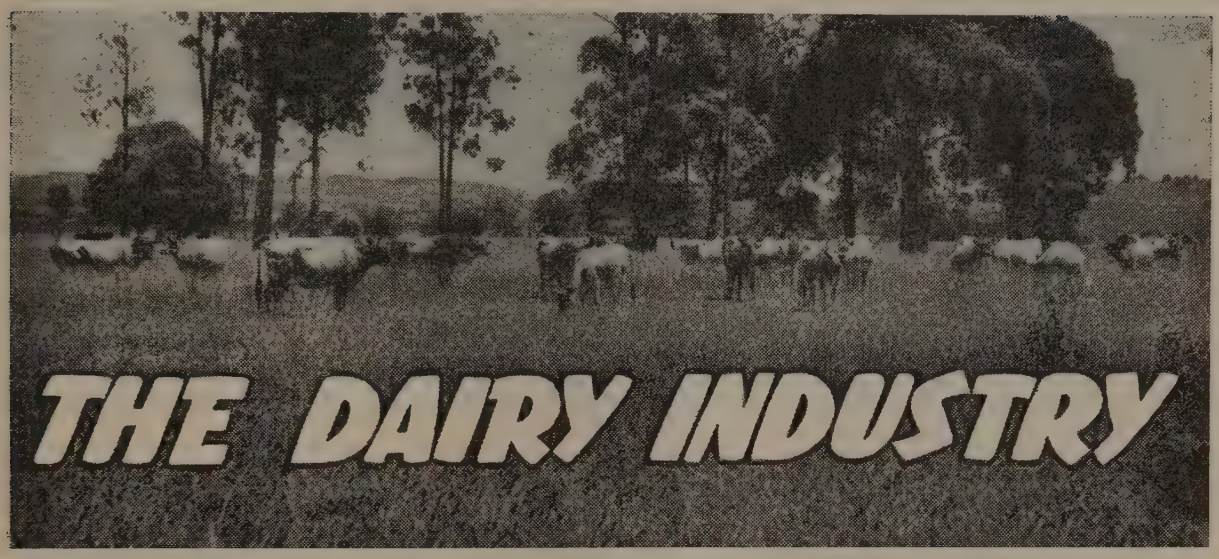
The illustration which appeared as mugga in Plate 17 in the June issue of the journal was of white bloodwood. The illustration below is of a mugga tree in the Botanic Gardens, Brisbane.



[TO BE CONTINUED.]

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 17th JULY, 1953.)

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S.	M. E. & E. Scott, " Wattlebrae " A.I.S. Stud, Kingaroy
	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus" Stud, Greenmount
	H. V. Littleton, " Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmer " Stud, Wondai
	W. G. Marquardt, " Springlands," Wondai
	A. C. and C. R. Marquardt, " Cedar Valley," Wondai
	A. H. Sokoll, " Sunny Crest " Stud, Wondai
	W. and A. G. Scott, " Welena" A.I.S. Stud, Blackbutt
	G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, " Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, " Groveley," M.S. 195, Pittsworth
	Edwards Bros., " Spring Valley " A.I.S. Stud, Kingaroy
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	" St. Christopher's " and " Iona " Studs, Brookfield road, Brisbane
	E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, " Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount
	J. F. Lau, " Rosallen " Jersey Stud, Goombungee
	G. Harley, Hopewell, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, " Yarradale," Yarraman
	A. L. Semgreen, " Tecoma," Coolabunia
	G. & V. Beattie, " Beauvern," Antigua, Maryborough
	L. E. Meier, " Ardath " Stud, Boonah
	A. M. and L. J. Noone, " Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango
	F. W. Verrall, " Coleburn," Walloon
	C. Beckingham, Trouts Road, Everton Park
	W. E. O. Meier & Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, " Ryecombe," Ravensbourne
polled Hereford ..	W. Maller, " Boreview," Pickanjinnie



Survey of Group Herd Recording Data, 1948-1952.

S. E. PEGG and C. H. CLARK, Herd Recording Section, Division of Dairying.

HERD recording is practised by dairy-farmers as a basis for herd improvement. Much valuable information can be made available to the dairying industry as a result of analysing the data collected from the members of the scheme.

The Group Herd Recording Scheme commenced in 1948 and the data up to 30th September, 1952, have been surveyed. As this period covers better-than-average, average and below-average seasons, it is considered that the information is fairly representative of what may be expected to occur over a period of years.

Effect of Month of Calving on Production.

This survey has been conducted to indicate the best months in which to calve cows in order to obtain best production, and the information has been presented for the whole of the State as well as for districts.

The average yields of milk and butterfat for the cows calving in the various months are given in Table 1, together with the number of lactations and the percentage of lactations for each month.

From Table 1 it is apparent that for the State as a whole the most profitable months in which to have cows calving are July, August and September, but the results for some districts show a slight departure from this trend.

On the Atherton Tableland the most favourable months are shown to be August and September, when the average butterfat production is 185 lb. and 183 lb. respectively. There is little variation for the months of May to July and October to January, but productions for cows calving in February and March are considerably lower.

There are insufficient cows represented in the Mackay, Port Curtis, Upper Burnett and Central Burnett districts to draw definite conclusions, but the trends may be seen from the figures given in the table.

In the South Burnett district the most favourable period for calving is spread over the four months July to October inclusive, whilst in

TABLE 1.

Effect of Month of Calving on Average Production, 1948–52.

District.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
All Queensland ..	lb. 2,895	lb. 126	lb. 2,837	lb. 126	lb. 2,929	lb. 127	lb. 3,097	lb. 134	lb. 3,269	lb. 141	lb. 3,372	lb. 145	lb. 3,484	lb. 150	lb. 3,510	lb. 151	lb. 3,412	lb. 149	lb. 3,290	lb. 143	lb. 3,165	lb. 138	lb. 2,981	lb. 130
	5,853* (6·96)†		4,518 (5·37)		4,403 (5·23)		4,290 (5·10)		4,663 (5·54)		6,072 (7·22)		7,794 (9·26)		9,247 (10·99)		10,204 (12·13)		10,736 (12·76)		9,235 (10·97)		7,140 (8·48)	
Atherton Tableland	3,922	170	3,626	169	3,538	153	3,797	163	3,937	168	4,052	174	4,087	176	4,384	185	4,228	183	4,021	175	3,889	171	3,985	173
	565 (7·72)		493 (6·74)		470 (6·43)		501 (6·85)		490 (6·70)		580 (7·93)		634 (8·67)		625 (8·54)		692 (9·46)		858 (11·73)		762 (10·42)		645 (8·82)	
Mackay	2,194	103	2,108	100	2,312	105	2,236	99	2,056	90	2,000	90	2,275	104	2,280	103	2,196	102	2,417	111	2,383	112	2,401	114
	78 (9·84)		57 (7·19)		85 (10·72)		67 (8·45)		51 (6·43)		68 (8·58)		76 (9·58)		81 (10·21)		76 (9·58)		58 (7·31)		43 (5·42)		53 (6·68)	
Port Curtis ..	1,075	48	1,143	52	1,033	49	1,266	56	1,491	64	1,244	54	2,104	92	2,544	119	2,567	115	2,240	100	1,843	82	1,350	59
	71 (7·11)		35 (3·51)		16 (1·60)		17 (1·70)		19 (1·90)		42 (4·21)		24 (2·40)		114 (11·42)		114 (11·42)		159 (15·93)		210 (21·04)		177 (17·74)	
Upper Burnett ..	3,202	135	2,643	113	3,241	140	3,244	139	3,440	147	3,922	164	4,174	170	4,112	170	4,152	172	3,981	164	3,889	161	3,316	137
	244 (7·41)		162 (4·92)		175 (5·32)		144 (4·37)		216 (6·56)		269 (8·17)		330 (10·02)		373 (11·33)		380 (11·54)		349 (10·60)		347 (10·54)		303 (9·20)	
Central Burnett ..	2,183	93	1,898	83	1,473	61	1,606	67	2,025	88	1,980	85	1,969	87	2,629	118	2,733	121	2,563	113	2,497	107	2,147	91
	173 (10·94)		88 (5·56)		87 (5·50)		66 (4·17)		78 (4·93)		94 (5·94)		84 (5·31)		164 (10·37)		181 (11·44)		231 (14·60)		192 (12·14)		144 (9·10)	
South Burnett ..	2,578	106	2,555	105	2,590	108	2,942	121	3,086	126	3,050	125	3,281	134	3,141	130	3,194	133	3,207	133	2,976	122	2,839	117
	688 (6·84)		536 (5·33)		503 (5·00)		556 (5·53)		598 (5·95)		742 (7·38)		930 (9·25)		1,110 (11·04)		1,251 (12·44)		1,233 (12·26)		1,079 (10·73)		828 (8·24)	
South-Eastern Queensland	2,629	119	2,588	119	2,696	121	2,795	125	2,993	134	3,126	138	3,153	142	3,266	147	3,112	144	3,031	140	2,915	134	2,759	126
	2,492 (6·64)		1,930 (5·14)		1,761 (4·69)		1,772 (4·72)		1,987 (5·29)		2,718 (7·24)		3,595 (9·58)		4,214 (11·23)		4,705 (12·54)		4,934 (13·15)		4,208 (11·21)		3,211 (8·56)	
Eastern Downs ..	3,426	144	3,440	147	3,440	147	3,702	160	3,827	163	4,053	173	4,156	175	4,105	173	3,982	166	3,746	156	3,711	156	3,480	147
	1,170 (7·08)		930 (5·63)		1,009 (6·11)		858 (5·19)		926 (5·61)		1,152 (6·98)		1,530 (9·26)		1,882 (11·40)		2,018 (12·22)		2,053 (12·43)		1,727 (10·46)		1,261 (7·64)	
Western Downs ..	2,653	105	2,475	101	2,705	111	2,758	111	3,165	128	3,113	125	3,475	141	3,376	134	3,409	138	3,244	128	3,086	123	2,769	111
	372 (6·12)		287 (4·72)		297 (4·89)		309 (5·08)		298 (4·90)		407 (6·70)		591 (9·72)		684 (11·25)		787 (12·95)		861 (14·17)		667 (10·97)		518 (8·52)	

* Number of cows calved in month.

† Percentage of all cows.

South-eastern Queensland and the Western Downs the most favourable months are July to September. The best period is a little earlier on the Eastern Downs, being from June to August.

Table 2 shows for the whole of the State the average production of all cows which calved during each quarter of the year.

TABLE 2.

Production According to the Time of Calving.

Time of Calving.	Percentage of Calvings.	Average Production.	
		Milk.	Butterfat.
		Lb.	Lb.
1st quarter (Jan.–Mar.)	17·56	2,887	126
2nd quarter (Apr.–June)	17·86	3,261	140
3rd quarter (July–Sept.)	32·38	3,466	150
4th quarter (Oct.–Dec.)	32·21	3,166	138

The table shows that the average production per cow for those calving in the July to September quarter of the year is 19% higher than that of cows calving in the first quarter, 7% higher than that of those calving in the second quarter, and 9% higher than that of those calving in the fourth quarter.

This information emphasizes the possibilities of increasing production by adopting "seasonal calving" and having as great a proportion of the cows as possible calve in the third quarter of the year. Seasonal calving has been adopted in many countries, and production per cow has shown appreciable improvement as a result. New Zealand is perhaps the country which is best known for the widespread adoption of this practice.

Many farmers have been averse to calving their cows in late winter and early spring months, during which pastures are usually poor, but the results of this survey definitely show the advantage to be gained.

Cows which calve in the July to September period obtain the benefit of the flush growth of grass usually experienced from January to March after they have been in production from 4-6 months, and it serves to prolong the length of lactation and increase the production for the lactation period. Cows which calve during the first quarter of the year are usually mated as the nutritive value of the grass is waning, and pregnancy during a time of poor feed tends to shorten the lactation period and lower the production of the animal.

It is realised that suppliers of market milk cannot afford to allow their supply to drop below a certain quantity at any portion of the year and therefore are not in the position to adopt the practice of calving a large number of cows within the one quarter. However, it is considered that such producers could obtain higher and cheaper production by eliminating all calvings in the first quarter of the year, which as the table shows is significantly the worst time of the year in which to have cows freshen.

Plate 1 depicts in graphical form the effect of the month of calving on production. It shows for the period 1948-52 the average production of milk and butterfat for cows calving in the various months, and the average production of butterfat according to the month of calving for

TABLE 3.

Effect of Month of Calving on Average Length of Lactation, 1948–52.

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
All Queensland	days. 194 5,853* (6·96)†	days. 199 4,518 (5·37)	days. 206 4,403 (5·23)	days. 216 4,290 (5·10)	days. 224 4,663 (5·54)	days. 228 6,072 (7·22)	days. 229 7,794 (9·26)	days. 226 9,247 (10·99)	days. 218 10,204 (12·13)	days. 209 10,736 (12·76)	days. 205 9,235 (10·97)	days. 197 7,140 (8·48)
Atherton Tableland	221 565 (7·72)	231 493 (6·74)	222 470 (6·43)	236 501 (6·85)	237 490 (6·70)	239 580 (7·93)	239 634 (8·67)	241 625 (8·54)	242 692 (9·46)	232 858 (11·73)	224 762 (10·42)	223 645 (8·82)
Mackay	180 78 (9·84)	185 57 (7·19)	185 85 (10·72)	189 67 (8·45)	193 51 (6·43)	197 68 (8·58)	200 76 (9·58)	198 81 (10·21)	190 76 (9·58)	203 58 (7·31)	193 43 (5·42)	191 53 (6·68)
Port Curtis	98 71 (7·11)	109 35 (3·51)	128 16 (1·60)	148 17 (1·70)	159 19 (1·90)	133 42 (4·21)	171 24 (2·40)	173 114 (11·42)	190 114 (11·42)	176 159 (15·93)	149 210 (21·04)	109 177 (17·74)
Upper Burnett	183 224 (7·41)	165 162 (4·92)	197 175 (5·32)	198 144 (4·37)	211 216 (6·56)	221 269 (8·17)	226 330 (10·02)	222 373 (11·33)	221 380 (11·54)	209 349 (10·60)	203 347 (10·54)	187 303 (9·20)
Central Burnett	158 173 (10·94)	146 88 (5·56)	146 87 (5·50)	168 66 (4·17)	178 78 (4·93)	192 94 (5·94)	199 84 (5·31)	239 164 (10·37)	214 181 (11·44)	192 231 (14·60)	178 192 (12·14)	156 144 (9·10)
South Burnett	184 688 (6·84)	185 536 (5·33)	193 503 (5·00)	208 556 (5·53)	215 598 (5·95)	216 742 (7·38)	221 930 (9·25)	220 1,110 (11·04)	209 1,251 (12·44)	206 1,233 (12·26)	192 1,079 (10·73)	191 828 (8·24)
South-Eastern Queensland ..	197 2,492 (6·64)	203 1,930 (5·14)	214 1,761 (4·69)	223 1,772 (4·72)	234 1,987 (5·29)	240 2,718 (7·24)	238 3,595 (9·58)	235 4,214 (11·23)	222 4,705 (12·54)	211 4,934 (13·15)	211 4,208 (11·21)	205 3,211 (8·56)
Eastern Downs	201 1,170 (7·08)	207 930 (5·63)	207 1,009 (6·11)	212 858 (5·19)	218 926 (5·61)	220 1,152 (6·98)	222 1,530 (9·26)	217 1,882 (11·40)	212 2,018 (12·22)	207 2,053 (12·43)	207 1,727 (10·46)	197 1,261 (7·64)
Western Downs	172 372 (6·12)	165 287 (4·72)	190 297 (4·89)	194 309 (5·08)	205 298 (4·90)	205 407 (6·70)	213 591 (9·72)	207 684 (11·25)	206 787 (12·95)	194 861 (14·17)	185 667 (10·97)	174 518 (8·52)

* Number of cows calving in month.

† Percentage of all cows.

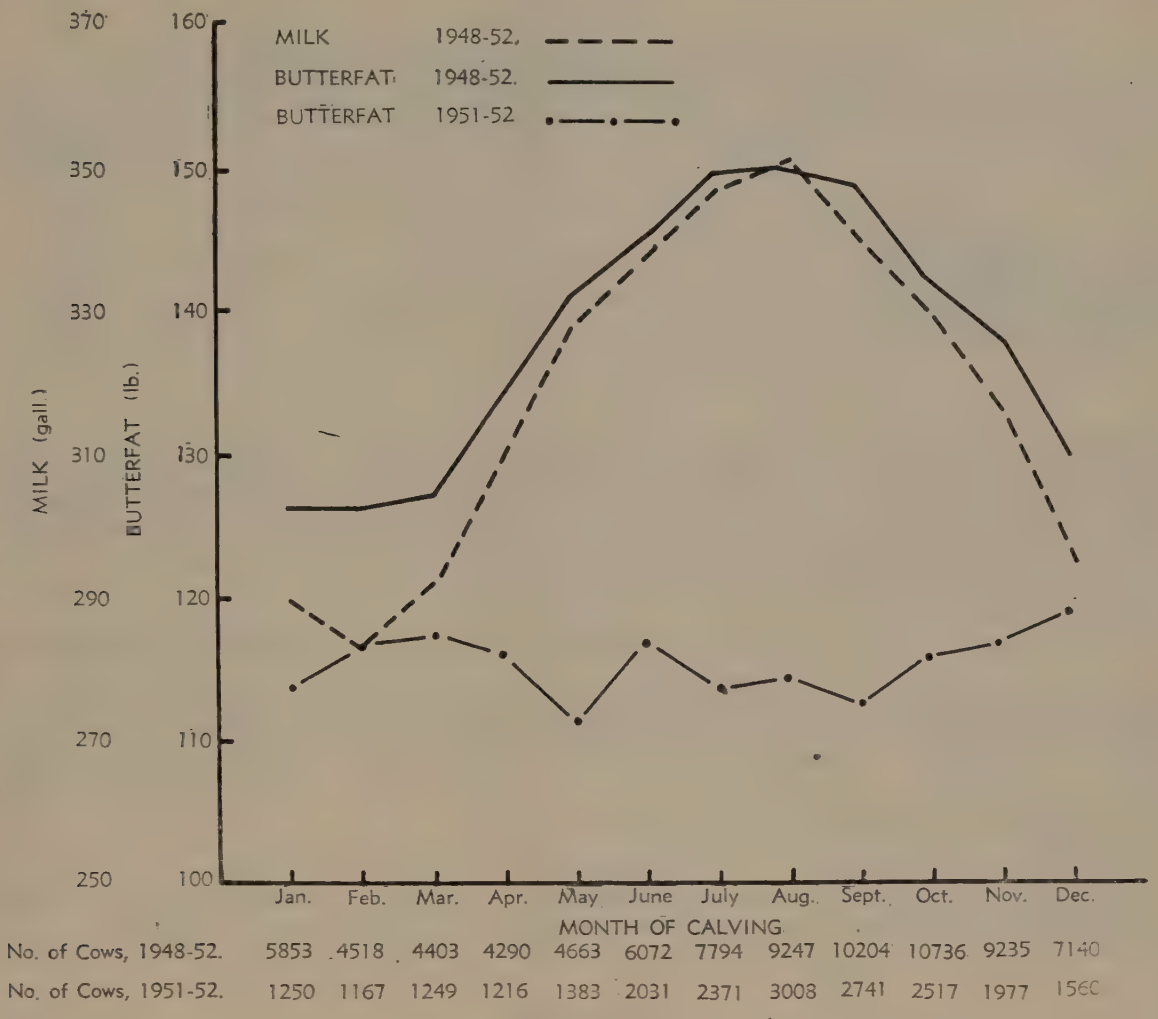


Plate 1.

Graph Showing the Effect of Month of Calving on Average Production. Milk and butterfat production are shown for all cows for the period 1948-52, and butterfat also for cows recorded in 1951-52.

1951-52. Because of the drought conditions which prevailed during 1951-52, the graph for that year not only shows abnormally low production for all months but also differs in shape from the average for 1948-52.

Since the first survey showing the effect of the month of calving on production was published a number of farmers in the State have adopted " seasonal calving."

Effect of Month of Calving on Length of Lactation.

The average length of lactation of cows varies according to the month of calving. It ranges from 194 days for cows which calved in January to 229 days for cows which calved in July. The months with the highest average lengths of lactation are June, July and August, with 228, 229 and 226 days respectively.

The average length of lactation of cows calving in the various months and in the various districts is shown in Table 3, together with the number and percentage of cows calving in each month.

Table 4 shows the average length of lactation for all cows for the whole of the State according to the quarter of the year.

TABLE 4.

Length of Lactation According to Time of Calving.

Time of Calving.	Average Length of Lactation.
	Days
1st quarter (Jan.–Mar.)	199
2nd quarter (Apr.–June)	223
3rd quarter (July-Sept.)	224
4th quarter (Oct.–Dec.)	204

This table shows that the average length of lactation for cows calving in the third quarter is 12% higher than that of cows calving in the first quarter of the year, 10% higher than that of those calving in the fourth quarter, and only one day longer than that of those calving in the second quarter of the year.

It would appear that the influence of early summer storms and the later general summer rains on the pastures has the effect of prolonging the lactation period of cows calving in the second and third quarters, whilst cows calving in the fourth and first quarters have their lactation periods shortened by the dry winter and spring conditions experienced in this State.

The months which tend to give the longest lactation periods vary slightly from district to district, as will be seen from Table 3.

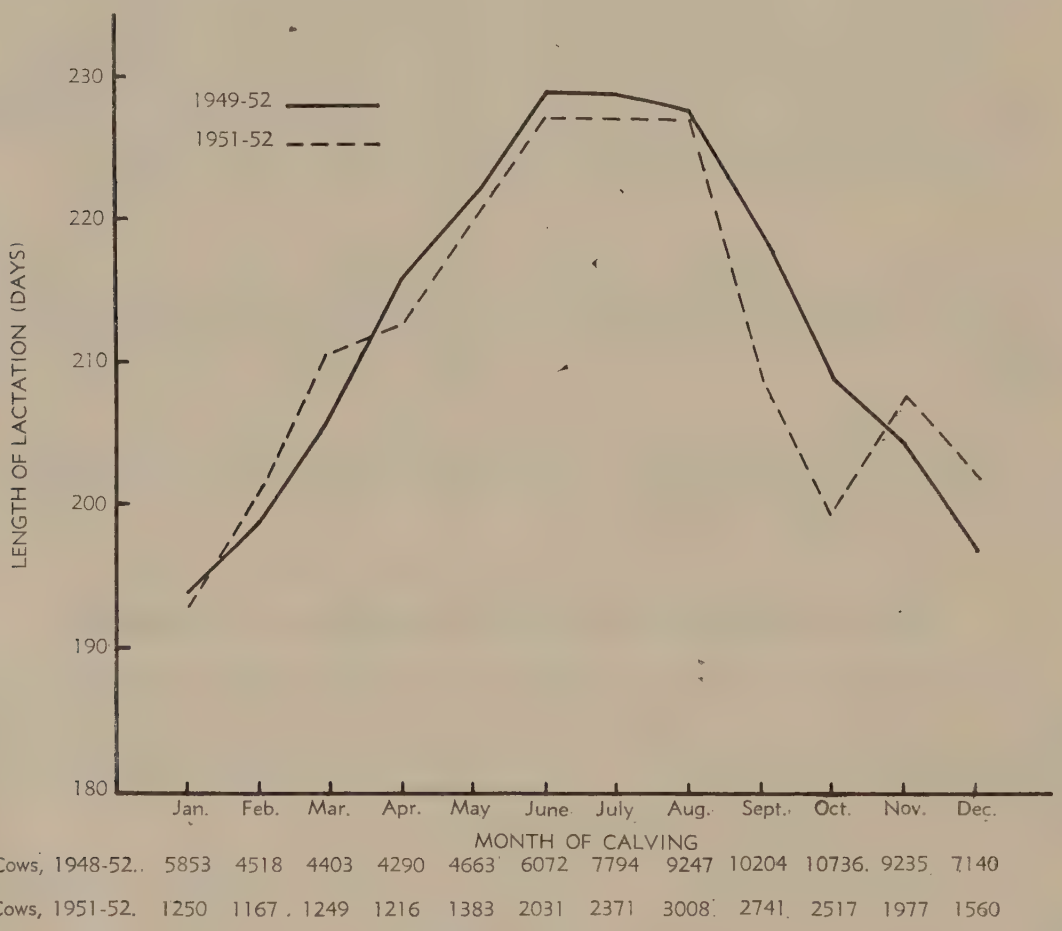


Plate 2.

Graph Showing the Effect of the Month of Calving on the Average Length of Lactation. The lactation period is shown for all cows for the period 1948-52 and for cows recorded in 1951-52.

In Plate 2 the variation from month to month is presented in graphical form for the 1948-52 period. The average length of lactation for the season 1951-52 is also shown.

Effect of Length of Lactation on Production.

The maximum recorded length of lactation in Queensland under the Group Herd Recording Scheme is 270 days. Table 5 shows the average production of cows which milked for various lactation periods for the whole of the State and for various districts.

A study of Table 5 shows that 30% of the cows milked for a full lactation period of 270 days for an average production of 180 lb. butterfat, whilst 20% milked for a period of less than six months. The average production per cow of the latter group was 63 lb. butterfat, or a loss of 117 lb. butterfat compared with the production of cows which milked for the full period. The value of the loss at present prices for commercial butter is £28 10s. per cow.

An examination of the information given in Table 5 shows the average production of cows milking for various periods to be as follows:—

Days.	Percentage of Cows.	Butterfat.	Percentage of the Average Production for 270 days.
		Lb.	
270	30·07	180	100
240	19·35	163	90
210	18·91	142	79
180	11·27	115	64
150	7·62	90	50
120	5·26	66	37
90	3·52	45	25
60	2·44	29	16
30	1·56	14	8

It is obvious that considerable production is lost through cows not milking for a full lactation period and the reasons for the short lactation period should be sought. They appear to be:—

(1) Low Standard of Nutrition.—This can be obviated by the conservation of adequate supplies of fodder in the form of ensilage and hay; planting a succession of suitable fodder crops for grazing; the establishment of improved pastures; and improved methods of pasture management.

(2) Calving Cows at any Period of the Year.—Greater production can be obtained by mating the cows so that they will calve during the most favourable months of the year. (See previous section on "The Effect of the Month of Calving on Production.")

(3) Control of Sire.—Many farmers allow the bull to run with the herd and frequently the period between calvings is only 10 months. Cows should have a dry period of at least two months before calving.

(4) Some strains of dairy cattle appear to have an inherited trait for milking for a short lactation period. Such strains or families should be eliminated from the herd.

TABLE 5.

Average Production Per Cow According to Length of Lactation, 1948–52.

District.	30 days.		60 days.		90 days.		120 days.		150 days.		180 days.		210 days.		240 days.		270 days.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
All Queensland	lb. 338	lb. 14	lb. 695	lb. 29	lb. 1,098	lb. 45	lb. 1,572	lb. 66	lb. 2,138	lb. 90	lb. 2,720	lb. 115	lb. 3,318	lb. 142	lb. 3,764	lb. 163	lb. 4,097	lb. 180
	1,404* (1·56)†		2,196 (2·44)		3,177 (3·52)		4,739 (5·26)		6,869 (7·62)		10,156 (11·27)		17,046 (18·91)		17,446 (19·35)		27,117 (30·07)	
Atherton Tableland	394	17	775	32	1,158	49	1,675	73	2,289	98	2,985	127	3,674	157	4,164	179	4,580	199
	55 (0·71)		113 (1·46)		143 (1·85)		232 (3·00)		373 (4·83)		624 (8·07)		1,533 (19·83)		1,758 (22·75)		2,898 (37·49)	
Mackay	276	15	543	25	949	42	1,215	56	1,763	79	2,041	94	2,427	111	2,989	136	3,138	144
	23 (2·89)		34 (4·27)		50 (6·28)		63 (7·91)		75 (9·42)		118 (14·82)		160 (20·10)		137 (17·21)		136 (17·08)	
Port Curtis	334	16	601	26	936	41	1,366	61	2,044	92	2,435	107	2,598	115	2,904	130	3,312	149
	54 (4·44)		82 (6·75)		126 (10·38)		168 (13·83)		220 (18·11)		131 (10·78)		168 (13·83)		146 (12·02)		120 (9·87)	
Upper Burnett	416	17	875	36	1,348	54	1,880	78	2,693	111	3,164	129	3,925	163	4,499	188	4,739	200
	86 (2·44)		104 (2·95)		137 (3·89)		212 (6·02)		362 (10·28)		441 (12·52)		606 (17·21)		602 (17·10)		971 (27·58)	
Central Burnett	301	12	649	27	1,086	45	1,497	61	1,905	80	2,477	105	2,771	122	2,975	131	3,267	145
	73 (4·56)		75 (4·69)		130 (8·13)		152 (9·50)		222 (13·88)		185 (11·56)		232 (14·50)		173 (10·81)		358 (22·37)	
South Burnett	328	14	618	24	1,088	43	1,514	61	2,117	85	2,697	109	3,354	136	3,654	152	3,982	165
	232 (2·12)		311 (2·84)		446 (4·07)		667 (6·08)		972 (8·86)		1,479 (13·48)		2,081 (18·97)		1,922 (17·52)		2,859 (26·06)	
South-Eastern Queensland	293	13	614	26	977	43	1,420	62	1,880	84	2,388	107	2,899	130	3,353	151	3,637	167
	515 (1·29)		812 (2·03)		1,168 (2·93)		1,811 (4·54)		2,688 (6·73)		4,140 (10·37)		7,265 (18·19)		7,963 (19·94)		13,568 (33·99)	
Eastern Downs	396	16	855	35	1,272	51	1,835	75	2,481	102	3,215	134	4,023	168	4,438	187	4,916	212
	245 (1·36)		404 (2·25)		620 (3·45)		964 (5·36)		1,379 (7·66)		2.169 (12·05)		3,581 (19·90)		3,626 (20·15)		5,006 (27·82)	
Western Downs	391	14	776	29	1,165	44	1,653	63	2,278	88	2,878	112	3,515	141	4,003	164	4,316	177
	121 (1·93)		251 (4·00)		357 (5·68)		470 (7·48)		578 (9·20)		869 (13·84)		1,339 (21·32)		1,119 (17·82)		1,176 (17·72)	

* Number of cows with lactation period shown.

† Percentage of all cows.

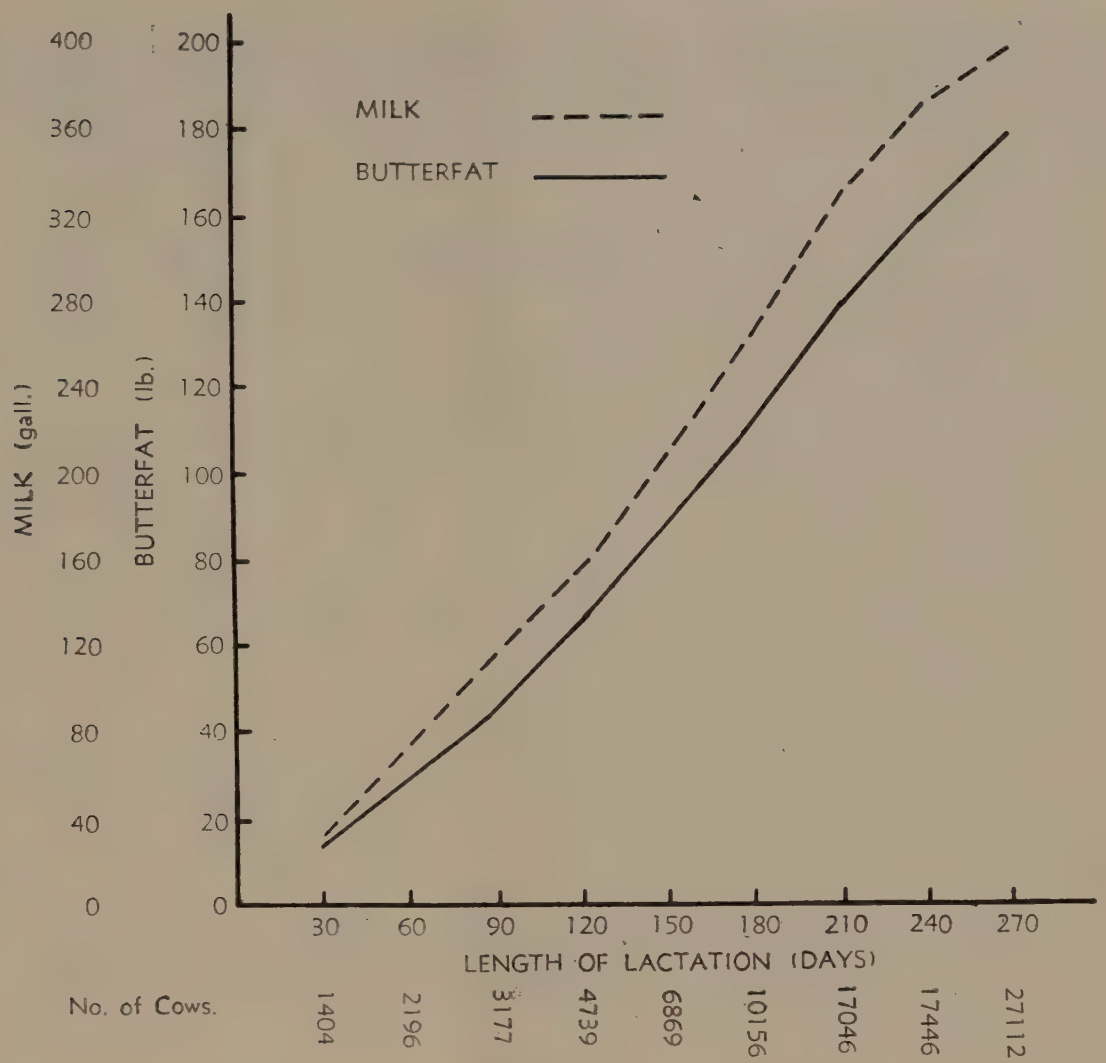


Plate 3.

Graph Showing Production of Milk and Butterfat According to the Length of Lactation, 1948-52.

Plate 3 depicts the average production according to length of lactation.

Relationship of Test to Production.

A survey carried out by the New Zealand Dairy Board has shown that within breeds there is a strong correlation between the butterfat content of the milk and the yield of butterfat, and it has been shown that if the standard of nutrition is high, a sound method of raising the level of butterfat production would be for farmers to breed from cow families which combine better-than-average tests with high milk yield.

Most dairy-farmers in this State supply butter or cheese factories and are paid according to the amount of butterfat supplied. It is therefore necessary for them to give consideration to the higher-testing cow families in their herds, provided such tests are associated with high milk yields.

Suppliers of market milk are paid a flat rate per gallon irrespective of the butterfat content and they are therefore concerned only with the amount of milk produced, provided it contains not less than the prescribed standard of butterfat. These suppliers may be forced to give more attention to the butterfat content of the milk in the future

TABLE 6.

Production According to Test. All Cows, 1948–52.

District.	Under 3·0%		3·0%–3·4%		3·5%–3·9%		4·0%–4·4%		4·5%–4·9%		5·0%–5·4%		5·5%–5·9%		6·0%–6·4%		6·5% and over.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
All Queensland	1,786	50	3,218	106	3,615	135	3,389	142	3,151	147	3,081	156	2,690	166	2,639	162	1,956	132
	896* (0·99)†		6,867 (7·61)		20,064 (22·24)		24,466 (27·12)		18,339 (20·33)		12,701 (14·08)		4,929 (5·46)		1,519 (1·68)		431 (0·48)	
Atherton Tableland	2,653	76	4,181	138	4,655	174	4,322	181	3,663	172	3,324	172	3,023	171	2,851	175	2,002	135
	35 (0·45)		534 (6·91)		1,786 (23·10)		2,048 (26·49)		1,499 (19·39)		1,112 (14·38)		511 (6·61)		150 (1·94)		56 (0·73)	
Mackay	375	32	2,258	76	2,471	92	2,367	99	2,160	101	2,177	113	2,304	131	1,815	112	894	60
	2 (0·25)		22 (2·75)		101 (12·63)		207 (25·88)		234 (29·25)		152 (19·00)		51 (6·38)		24 (3·00)		7 (0·88)	
Port Curtis	783	34	1,738	57	2,150	81	2,090	89	2,034	96	1,946	100	1,895	107	958	58	1,035	70
	11 (0·90)		40 (3·29)		218 (17·93)		361 (29·69)		323 (26·56)		175 (14·39)		65 (5·35)		17 (1·40)		6 (0·50)	
Upper Burnett	2,129	58	3,430	113	4,061	153	3,914	164	3,500	164	3,187	165	3,147	174	2,505	154	1,539	105
	31 (0·88)		224 (6·34)		999 (28·28)		1,320 (37·37)		611 (17·30)		266 (7·53)		55 (1·56)		18 (0·51)		8 (0·23)	
Central Burnett	970	27	1,879	62	2,209	83	2,344	98	2,508	118	2,372	123	2,210	124	1,812	111	1,170	82
	16 (1·00)		101 (6·31)		368 (23·00)		487 (30·44)		365 (22·81)		182 (11·38)		52 (3·25)		24 (1·50)		5 (0·32)	
South Burnett	1,639	46	2,950	98	3,378	126	3,158	134	2,902	136	2,678	138	2,301	130	2,147	132	1,592	109
	186 (1·69)		1,259 (11·43)		3,365 (30·54)		3,073 (27·89)		1,642 (14·90)		973 (8·83)		366 (3·32)		113 (1·03)		40 (0·37)	
South-Eastern Queensland	1,907	53	3,073	101	3,186	119	2,973	126	2,975	140	3,055	153	2,468	163	2,573	158	1,999	136
	229 (0·57)		2,035 (5·09)		5,987 (14·98)		9,776 (24·46)		10,249 (25·65)		7,702 (19·27)		2,895 (7·24)		856 (2·14)		231 (0·58)	
Eastern Downs	1,981	55	3,580	120	4,150	155	4,015	168	3,739	175	3,542	184	3,489	197	3,112	191	2,264	149
	197 (1·09)		1,643 (9·09)		5,110 (28·28)		5,481 (30·33)		2,680 (14·83)		1,789 (9·90)		821 (4·54)		281 (1·56)		68 (0·38)	
Western Downs	1,524	42	2,864	94	3,276	122	3,348	118	3,242	151	2,976	154	2,964	167	3,159	222	2,067	122
	187 (2·98)		1,009 (16·08)		2,130 (33·95)		1,713 (27·30)		736 (11·73)		340 (5·42)		113 (1·80)		36 (0·57)		10 (0·16)	

* Number of cows in range.
† Percentage of all cows.

if the practice of drying milk develops, as in that case milk surplus to the wholemilk demand will be paid for on butterfat and/or milk solids content.

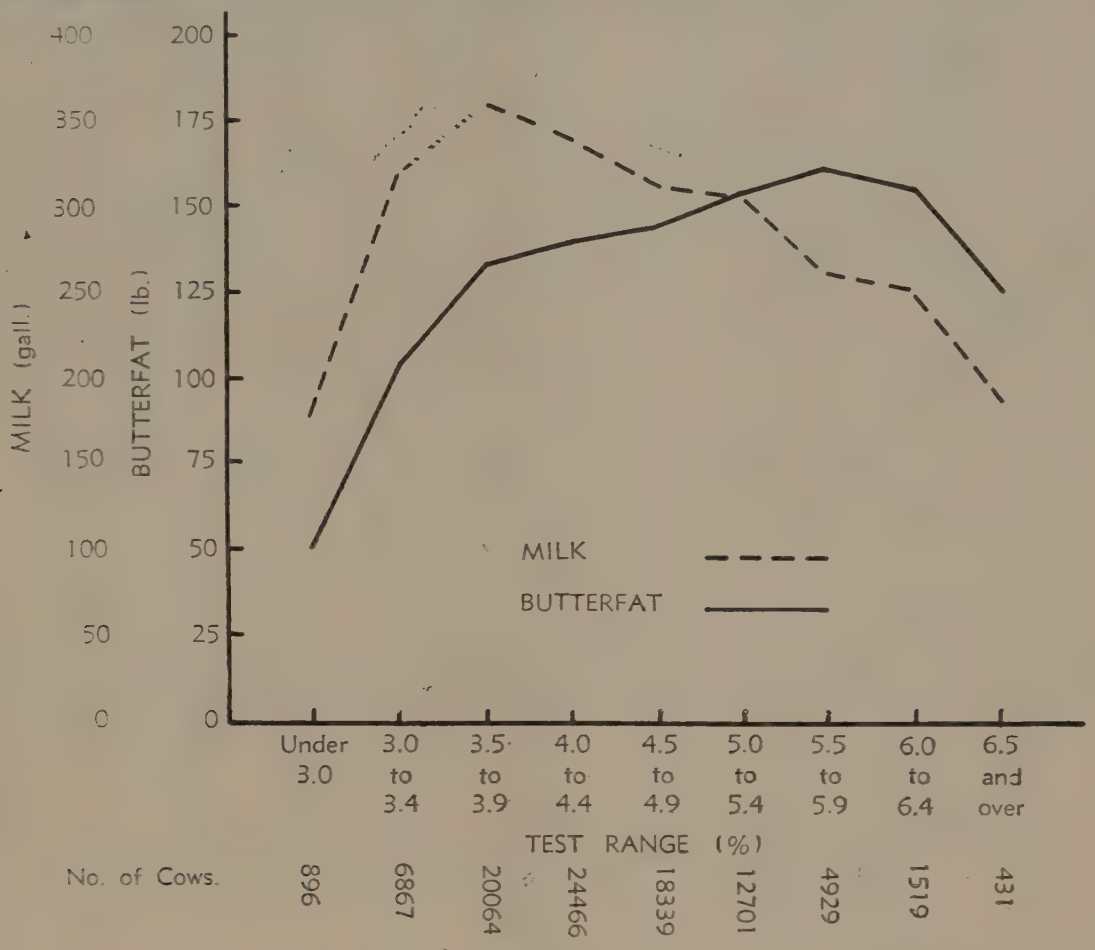


Plate 4.

Graph Showing the Relationship between Butterfat Test of Milk and Production.
The figures are for all cows recorded in 1948-52.

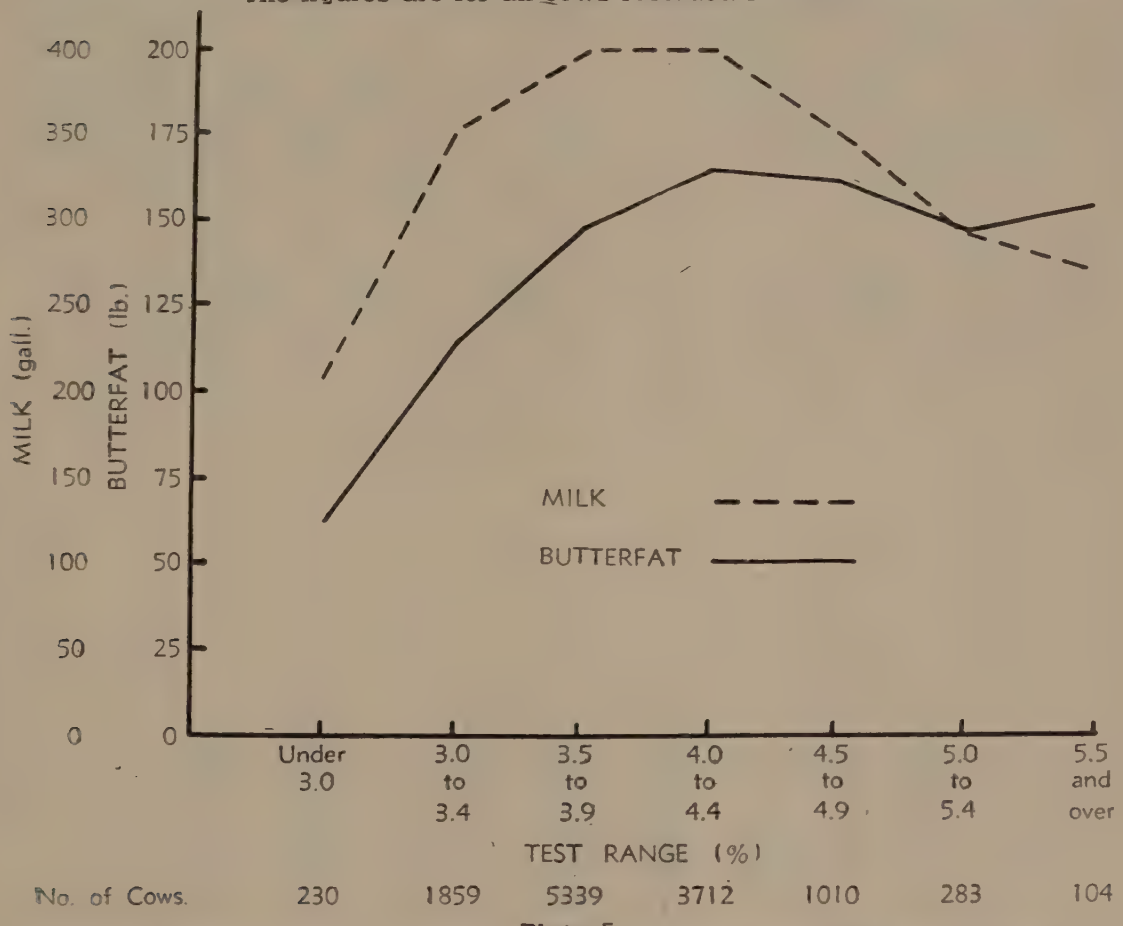


Plate 5.

Graph Showing the Relationship between Butterfat Test of Milk and Production.
The figures are for A.I.S. cows recorded in 1949-52.

TABLE 7.

Production According to Test. A.I.S. Cows, 1949–52.

District.	Under 3·0%		3·0%–3·4%		3·5%–3·9%		4·0%–4·4%		4·5%–4·9%		5·0%–5·5%		Over 5·5%	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
All Queensland	lb. 2,143	lb. 63	lb. 3,527	lb. 116	lb. 4,032	lb. 150	lb. 4,036	lb. 168	lb. 3,567	lb. 165	lb. 2,974	lb. 153	lb. 2,801	lb. 160
	230* (1·83)†		1,859 (14·83)		5,339 (42·59)		3,712 (29·61)		1,010 (8·06)		283 (2·26)		104 (0·83)	
Atherton Tableland	3,351	96	4,372	145	4,937	184	4,920	205	4,528	216	4,427	225	3,875	224
	16 (0·62)		345 (13·29)		1,079 (41·58)		891 (34·34)		208 (8·02)		42 (1·62)		14 (0·54)	
Mackay	..	..	3,586	123	3,120	117	3,026	126	2,416	112	3,107	158	2,246	132
	.. ..		6 (8·82)		26 (38·24)		20 (29·41)		8 (11·76)		3 (4·41)		5 (7·35)	
Port Curtis	..	..	..	..	2,330	87	2,634	110	..	..	1,840	94	..	..
	.. ..		.. ..		9 (45·00)		8 (40·00)		.. ..		3 (15·00)		.. ..	
Upper Burnett	4,950	116	3,810	125	4,036	152	4,143	174	3,281	154	2,895	150	2,606	169
	1 (0·21)		15 (3·18)		124 (26·33)		202 (42·89)		87 (18·47)		34 (7·22)		8 (1·79)	
Central Burnett	1,885	56	1,988	65	2,544	95	2,642	110	3,062	141	1,865	96	2,198	130
	1 (0·35)		34 (11·97)		122 (42·96)		85 (29·93)		31 (10·92)		8 (2·82)		3 (1·05)	
South Burnett	1,354	38	3,592	118	4,308	160	4,016	167	3,708	170	2,664	136	3,125	176
	16 (1·65)		145 (14·98)		459 (47·42)		278 (28·72)		55 (5·68)		14 (1·45)		1 (0·10)	
South-Eastern Queensland	2,250	63	3,476	115	3,663	135	3,392	142	2,911	136	2,669	138	2,706	154
	45 (1·41)		518 (16·20)		1,347 (42·13)		845 (26·43)		272 (8·51)		118 (3·69)		52 (1·62)	
Eastern Downs	3,680	119	3,945	131	4,525	169	4,408	183	4,131	191	3,342	170	1,956	95
	40 (2·01)		211 (10·62)		888 (44·69)		658 (33·12)		155 (7·80)		29 (1·46)		6 (0·30)	
Western Downs	1,463	41	2,988	98	3,390	126	3,337	139	3,066	141	2,458	125	2,643	149
	111 (3·71)		585 (19·55)		1,285 (42·95)		770 (25·74)		194 (6·48)		32 (1·07)		15 (0·50)	

* Number of cows in range.

† Percentage of all A.I.S. cows.

TABLE 8.

Production According to Test. Jersey Cows, 1949–52.

District.	Under 3·0%		3·0%–3·4%		3·5%–3·9%		4·0%–4·4%		4·5%–4·9%		5·0%–5·4%		5·5%–5·9%		6·0%–6·4%		6·5% and over.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Fat..	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
All Queensland	573	14	2,086	70	2,589	98	2,927	124	3,064	145	3,153	164	3,059	173	2,881	177	2,079	148
	41* (0·24)†		209 (1·20)		1,086 (6·23)		3,644 (20·91)		5,310 (30·47)		4,528 (25·98)		1,911 (10·97)		552 (3·17)		147 (0·84)	
Atherton Tableland	1,020	30	3,515	120	3,464	131	3,549	151	3,485	164	3,420	178	3,073	171	3,099	190	2,245	152
	3 (0·12)		22 (0·88)		103 (4·12)		388 (15·53)		720 (28·82)		760 (30·42)		360 (14·41)		108 (4·32)		34 (1·36)	
Mackay	585	17	1,498	49	2,951	113	2,511	107	2,201	103	2,417	126	2,864	164	2,393	148	1,208	80
	1 (0·50)		3 (1·57)		4 (2·09)		34 (17·80)		61 (31·94)		59 (30·89)		19 (9·95)		8 (4·19)		2 (1·05)	
Port Curtis	..	..	..	..	1,885	73	2,630	111	3,069	145	2,659	139	2,550	146	..	..	..	..
	.. ..		.. ..		3 (5·77)		11 (21·15)		10 (19·23)		17 (32·69)		11 (21·15)		.. ..		.. ..	
Upper Burnett	1,350	36	3,553	121	3,492	130	3,617	153	3,359	158	2,832	148	1,956	111	1,463	91	1,870	128
	1 (0·23)		21 (4·88)		101 (23·49)		167 (38·84)		84 (19·53)		40 (9·30)		10 (2·33)		3 (0·70)		3 (0·70)	
Central Burnett	885	23	1,385	45	1,989	77	2,242	95	2,498	118	2,441	126	2,315	129	2,109	129	1,785	117
	1 (0·21)		9 (1·88)		43 (8·96)		152 (31·67)		159 (33·13)		75 (15·63)		24 (5·00)		16 (3·33)		1 (0·21)	
South Burnett	340	9	1,965	66	1,864	70	2,656	112	2,624	123	2,521	130	2,533	143	2,268	139	1,918	132
	3 (0·30)		19 (1·90)		104 (10·39)		243 (24·28)		305 (30·47)		210 (20·98)		83 (8·29)		26 (2·60)		8 (0·80)	
South-Eastern Queensland	361	9	1,609	54	2,190	84	2,741	116	2,995	141	3,109	162	3,038	172	2,778	171	2,127	144
	20 (0·18)		100 (0·92)		547 (5·01)		2,217 (20·30)		3,455 (31·63)		2,945 (26·96)		1,219 (11·16)		337 (3·09)		83 (0·76)	
Eastern Downs	365	9	1,514	50	3,806	144	3,669	157	3,653	172	3,757	195	3,841	218	3,853	236	1,647	108
	9 (0·89)		15 (1·48)		73 (7·19)		197 (19·41)		271 (26·70)		271 (26·70)		129 (12·71)		37 (3·65)		13 (1·28)	
Western Downs	2,035	47	2,302	76	3,047	114	3,339	141	3,260	154	3,268	170	3,090	175	3,577	221	2,065	134
	3 (0·36)		20 (2·39)		108 (12·89)		235 (28·04)		245 (29·24)		151 (18·02)		56 (6·68)		17 (2·03)		3 (0·36)	

* Number of cows in range.

† Percentage of all Jersey cows.

Table 6 shows the average milk and butterfat production of all cows within the various test ranges, while Tables 7 and 8 show the trends within the A.I.S. and Jersey breeds. This information is further depicted in Plates 4-6.

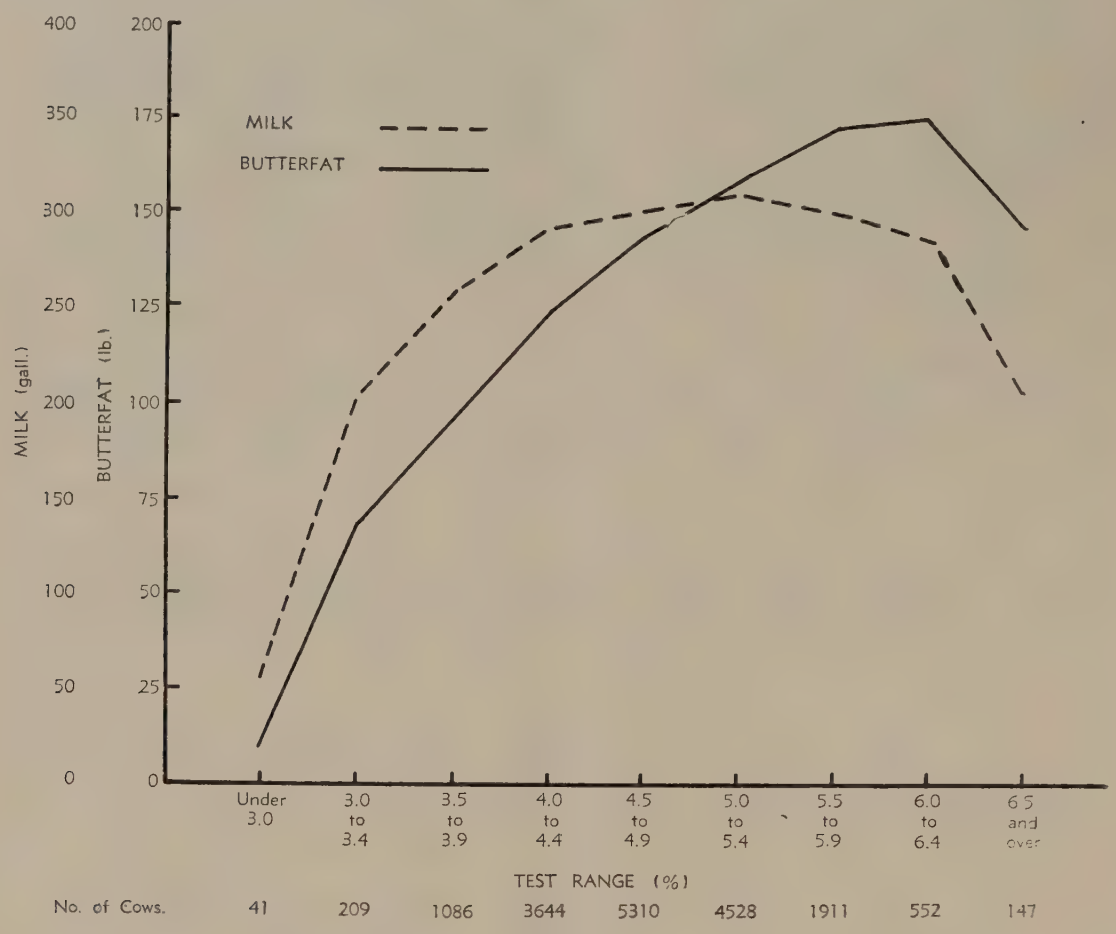


Plate 6.

Graph Showing the Relationship between Butterfat Test of Milk and Production.
The figures are for Jersey cows recorded in 1949-52.

In the A.I.S. breed survey there are 12,537 lactations and it is noted that the greatest yield of butterfat (168 lb.) is in the 4·0–4·4% range, in which there are 3,712 cows (29·61%). The average production of the 70·39% of cows outside this test range was 142 lb. butterfat. Thus the cows in the 4·0–4·4% test range produced 18·3% more butterfat than cows outside this range. The highest yield of milk was from cows in the ranges 3·5–4·4%, with a production in each case of 403 gall.; 9,051 cows (72·2%) are in these ranges.

There are 17,428 lactations in the Jersey survey. It is shown that the Jersey cows in the over 5·5% ranges had the highest average production of butterfat (172 lb.); in this range there are 2,610 lactations (15·0%). This production is 22% higher than the average production of butterfat (141 lb.) from the 85% of cows below this test range. The greatest yield of milk (315 gall.) was in the 5·0–5·4% range, which comprised 4,528 lactations (26%).

It is felt that the information supplied by these surveys and discussed in this article can be of much assistance to the dairy-farmer who applies it to his herd improvement programme.

Pure-bred Dairy Cattle Production Recording.

In the list of records which appeared on page 115 of the February issue of the Journal, the butterfat production of Glengarriffe Dreamer's Coulisse for 305 days should have been 426 lb., and Glengarriffe Dreamer's Hawthorn should have appeared as a Senior 4-year-old.



A Crush Bail.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

A well constructed crush and bail reduces time and labour when cattle have to be secured for such operations as dehorning, bleeding, inoculation, castration, and branding.

The design illustrated here is a modification of many types of bail in use and can be recommended for its simplicity and effectiveness.

Two strong iron plates are required for the end of the lever and a half-inch bolt to go through the plates and the slot in the sword.

If desired, the structure can be made of bush timber and a single round post can be morticed for the lever.

Where only quiet cattle are to be handled, lighter materials than those specified can be used.

The plan and/or the gates can be reversed if desired to suit existing yards and conditions.

The two half-gates on the crush have advantages which will be obvious to the practical cattleman.

The lower half being sheeted prevents the animals' legs from slipping through the rails, and by opening the top half free access is gained to the animal when operations such as branding and inoculation are being carried out.

The gates may be swung from either the front or the rear of the last panel of the crush. It is suggested that they be swung from the front so that when a beast is released from the bail it has to back and turn about to get out of the crush. This prevents rushing, tends to quieten the beast, ensures that it does not pass close by the bail lever, and reduces risk of injury to men working the bail and the gate.

Hinged cleats can be fitted to the gates to connect them when it is desired to use them as one gate.

Where large numbers of cattle are to be handled, the race should be extended and a series of at least two forcing yards should be provided.

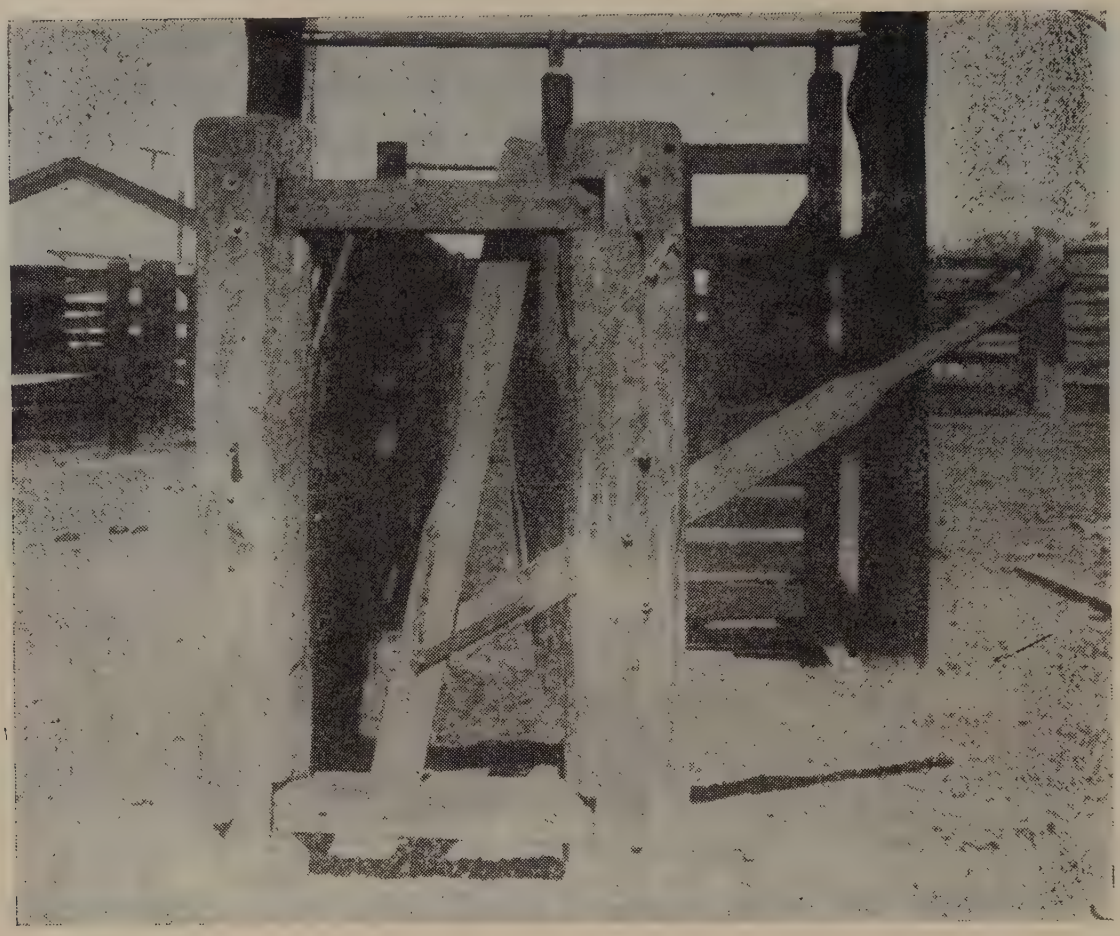


Plate 1.
Bail in Open Position.

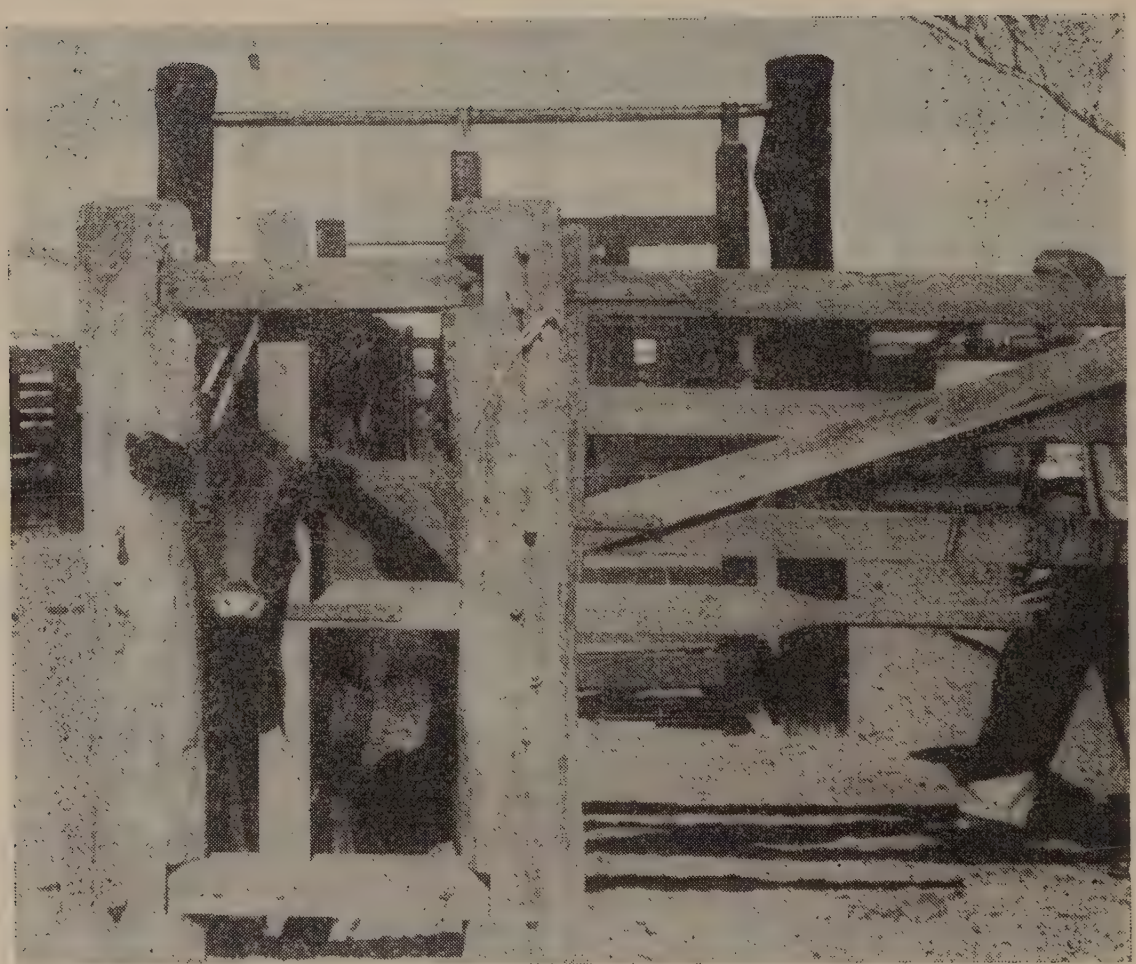


Plate 2.
Bail Closed.



Plate 3.

View of Double Gate, with Top Portion Open.

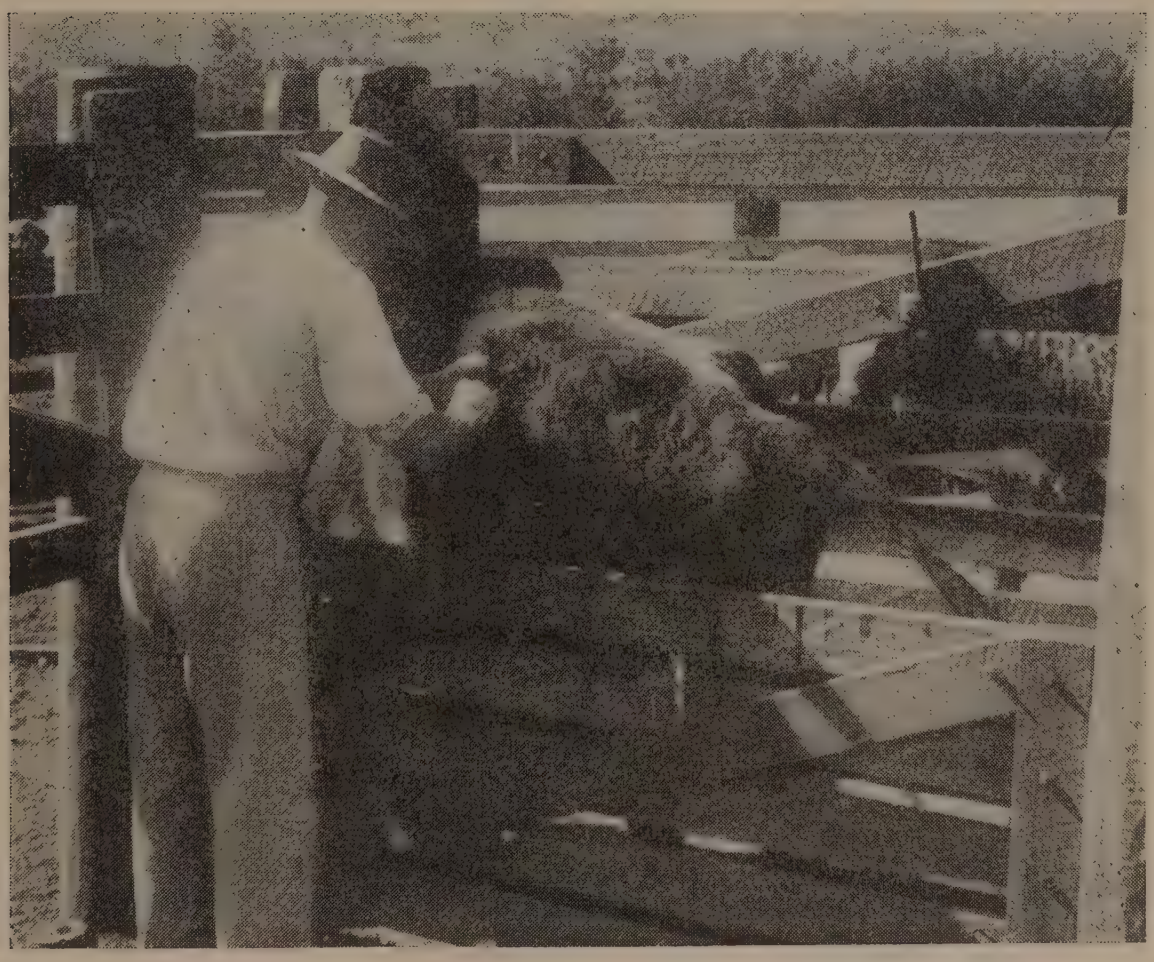


Plate 4.

Working with Cow in Double Gate.

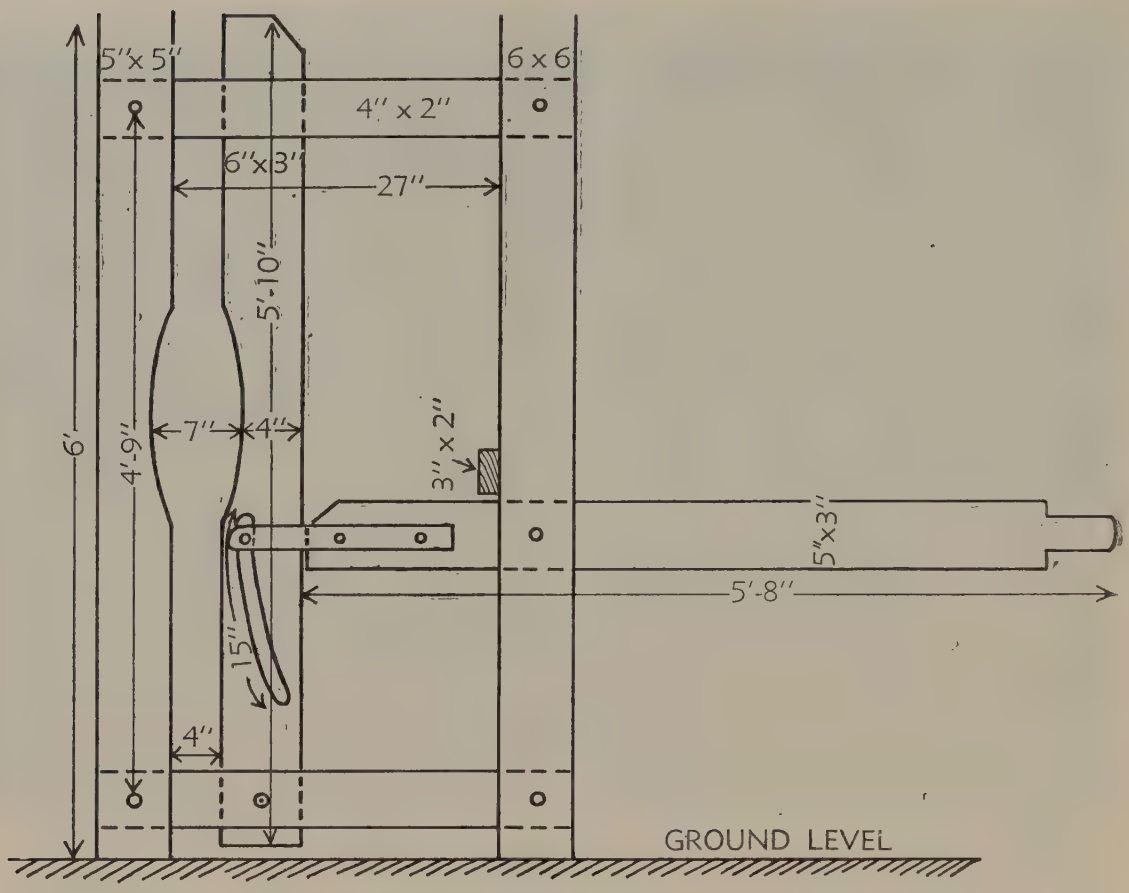


Plate 5.

Details of Lever Sword Bail.

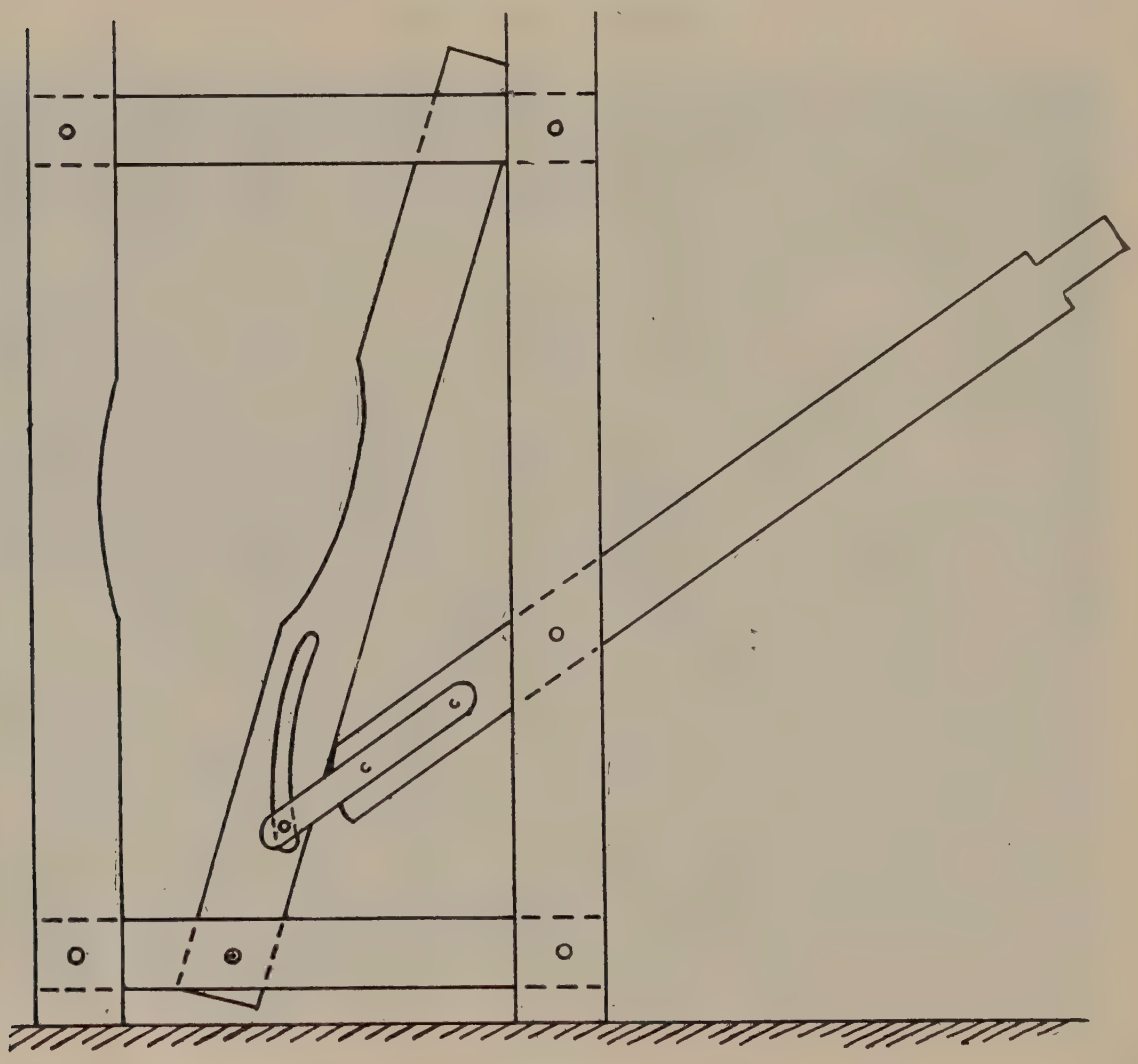


Plate 6.

Details of Bail in Open Position.

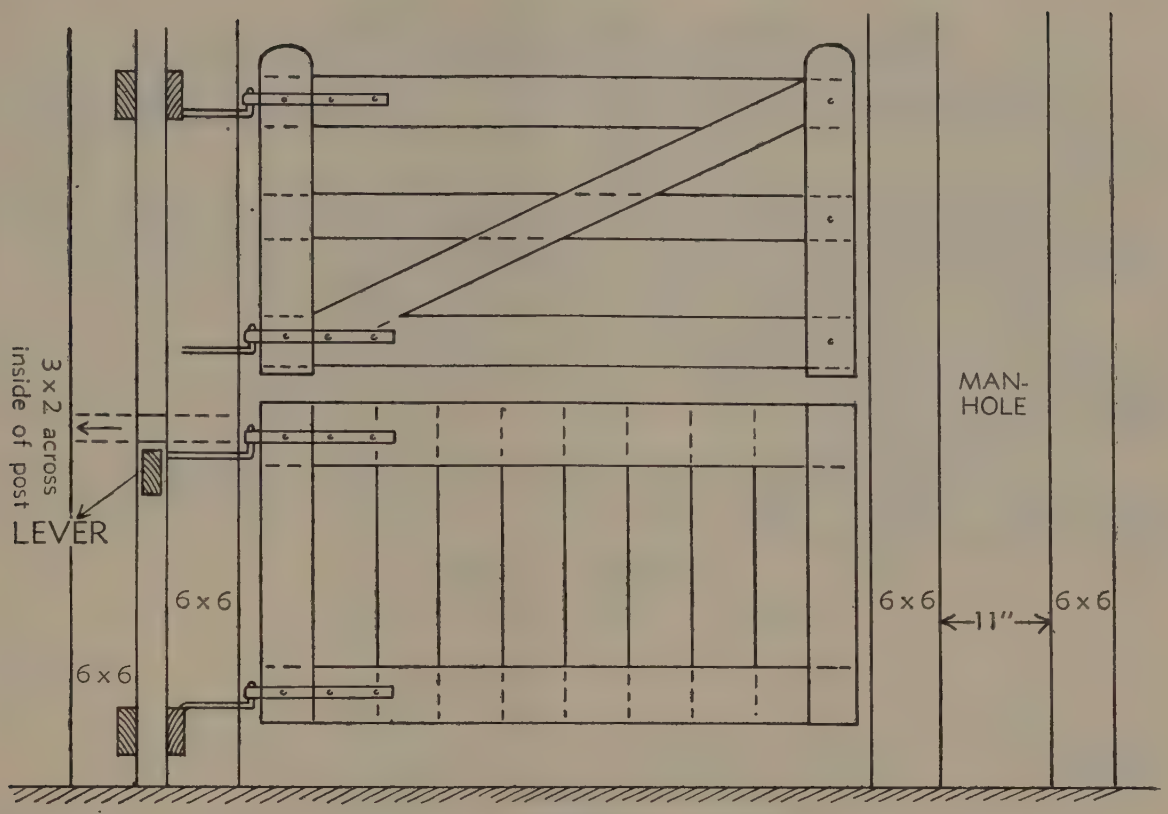


Plate 7.

Details of Double Gate, showing Bottom Gate Sheeted.

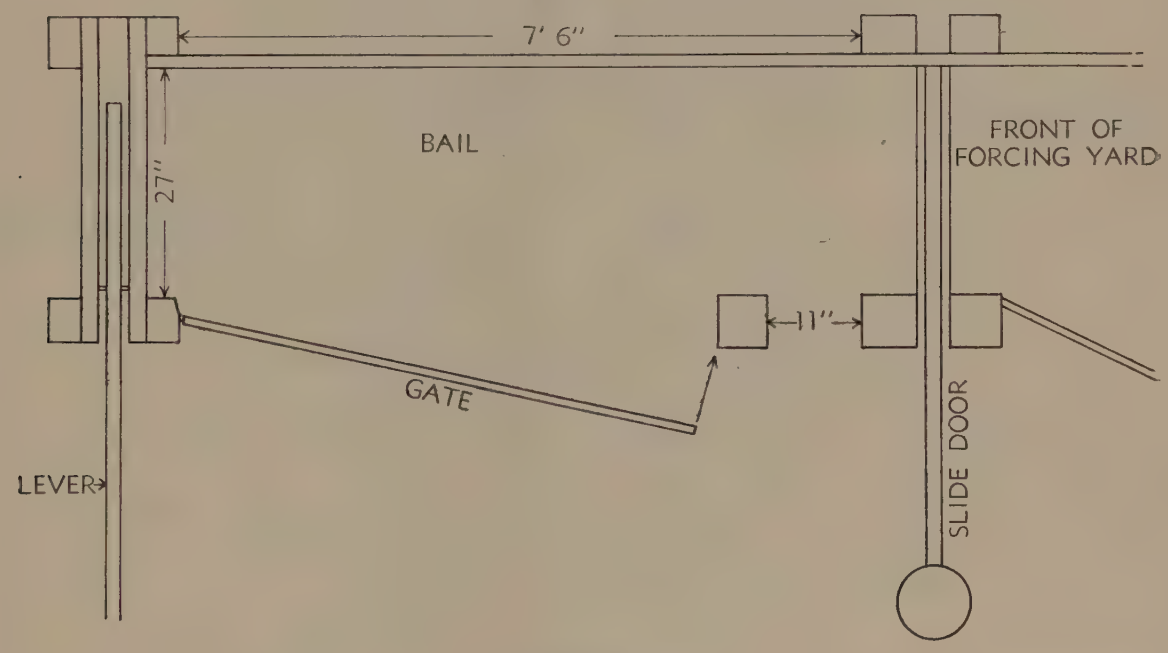


Plate 8.

Plan of Bail.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.
(AS AT 17th JULY, 1953.)

Breed.	Owner's Name and Address.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H.M. State Farm, " Palen " Stud, Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
	L. Puschmann, " Tayfeld " Stud, Taylor
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road Greenslopes
	W. F. Ruhle, " Felbar " Stud, Kalbar
	C. E. Edwards, " Spring Valley " Stud, Kingaroy
Large White	G. J. MacLennan, " Murcott " Stud, Willowvale
	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	H. R. Gibson, " Thistleton " Stud, Maleny

TESTED HERDS—continued.

Breed.	Owner's Name and Address.
Large White	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	N. Woltmann and Sons, Wooroolin
	R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, "Lauraven" Stud, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
	N. E. Meyers, Halpine Plantation, Kallangur
	Dr. B. J. Butcher & A. J. Parnwell, 684 Logan road, Greenslopes.
	G. I. Skyring, " Bellwood " Stud, via Pomona
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, "Canaan" Stud, Riverview
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
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ASTRONOMICAL DATA FOR QUEENSLAND.

SEPTEMBER

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.03	5.33	Cairns	27	31	Longreach	34	36
6	5.58	5.36	Charleville ..	27	27	Quilpie	35	35
11	5.52	5.38	Cloncurry	48	53	Rockhampton ..	9	11
16	5.46	5.40	Cunnamulla ..	29	29	Roma	17	17
21	5.40	5.42	Dirranbandi ..	19	19	Townsville ..	22	27
26	5.35	5.45	Emerald	18	20	Winton	38	42
30	5.30	5.46	Hughenden ..	33	37	Warwick	4	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	a.m.	a.m.
1	12.40	11.03
2	1.39	Noon
		p.m.
3	2.30	12.58
4	3.16	1.57
5	3.56	2.54
6	4.31	3.49
7	5.02	4.42
8	5.32	5.34
9	6.00	6.25
10	6.28	7.17
11	6.57	8.10
12	7.28	9.03
13	8.03	9.59
14	8.42	10.56
15	9.26	11.52
16	10.17	..
		a.m.
17	11.14	12.48
	p.m.	
18	12.16	1.40
19	1.22	2.29
20	2.29	3.13
21	3.36	3.54
22	4.44	4.33
23	5.53	5.11
24	7.02	5.49
25	8.11	6.29
26	9.21	7.13
27	10.28	8.02
28	11.30	8.56
29	..	9.53
	a.m.	
30	12.25	10.52

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27 ; Cunnamulla 29 ; Dirranbandi 19 ;
Quilpie 35 ; Roma 17 ; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	30	25	45	0	21	27	53
6	14	24	29	40	4	15	33	46
11	23	14	39	30	14	5	45	34
16	30	10	45	24	20	0	53	27
21	23	14	39	30	14	5	44	34
26	12	27	27	42	1	18	29	50
30	11	29	26	44	0	20	28	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5	55	35	67	19	52	5	45
3	5	52	35	65	19	50	5	44
5	10	45	37	60	22	46	9	37
7	20	36	44	55	29	40	18	31
9	29	26	50	47	35	33	25	22
11	39	17	56	42	41	27	33	16
13	47	8	63	36	47	21	39	8
15	53	4	67	33	50	19	44	5
17	54	4	67	33	51	19	44	5
19	47	8	63	36	47	21	39	8
21	37	18	55	43	40	27	31	17
23	25	30	47	50	32	35	21	25
25	13	41	39	58	24	44	12	35
27	6	51	35	64	20	50	6	43
29	5	53	35	66	19	51	5	44
30	7	52	36	65	20	50	7	44

Phases of the Moon.—New Moon, September 8, 5.47 p.m.; First Quarter, September 16, 7.49 p.m.; Full Moon, September 23, 2.15 p.m.; Last Quarter, September 30, 7.51 a.m.

On September 23 at 6 p.m. the sun will cross the equator and will then rise at true east and set at true west. On the 9th and 23rd the moon will rise and set approximately at true east and true west respectively.

Mercury.—At the beginning of the month, not far from Regulus in the constellation of Leo, will rise 15 minutes before the sun. It will be in line with the sun on the 7th, after which it will pass into the evening sky, and by the end of the month, in the constellation of Virgo not far from Spica, will set 1 hour 15 minutes after sunset.

Venus.—In the constellation of Taurus at the beginning of the month, rising 2 hours 50 minutes before the sun. About 2.30 p.m., on the 5th, the moon will pass in front of Venus. About the 23rd it will not be far from Regulus, and by the end of the month, in the constellation of Leo, will rise 1 hour 21 minutes before the sun.

Mars.—At the beginning of the month, in the constellation of Leo, will rise 47 minutes before the sun. On the 13th it will be placed near Regulus, and by the end of the month, still in the constellation of Leo, will rise 1 hour 13 minutes before sunrise.

Jupiter.—In the constellation of Taurus, will rise between 1.30 a.m. and 3 a.m. at the beginning of the month and about midnight at the end of the month.

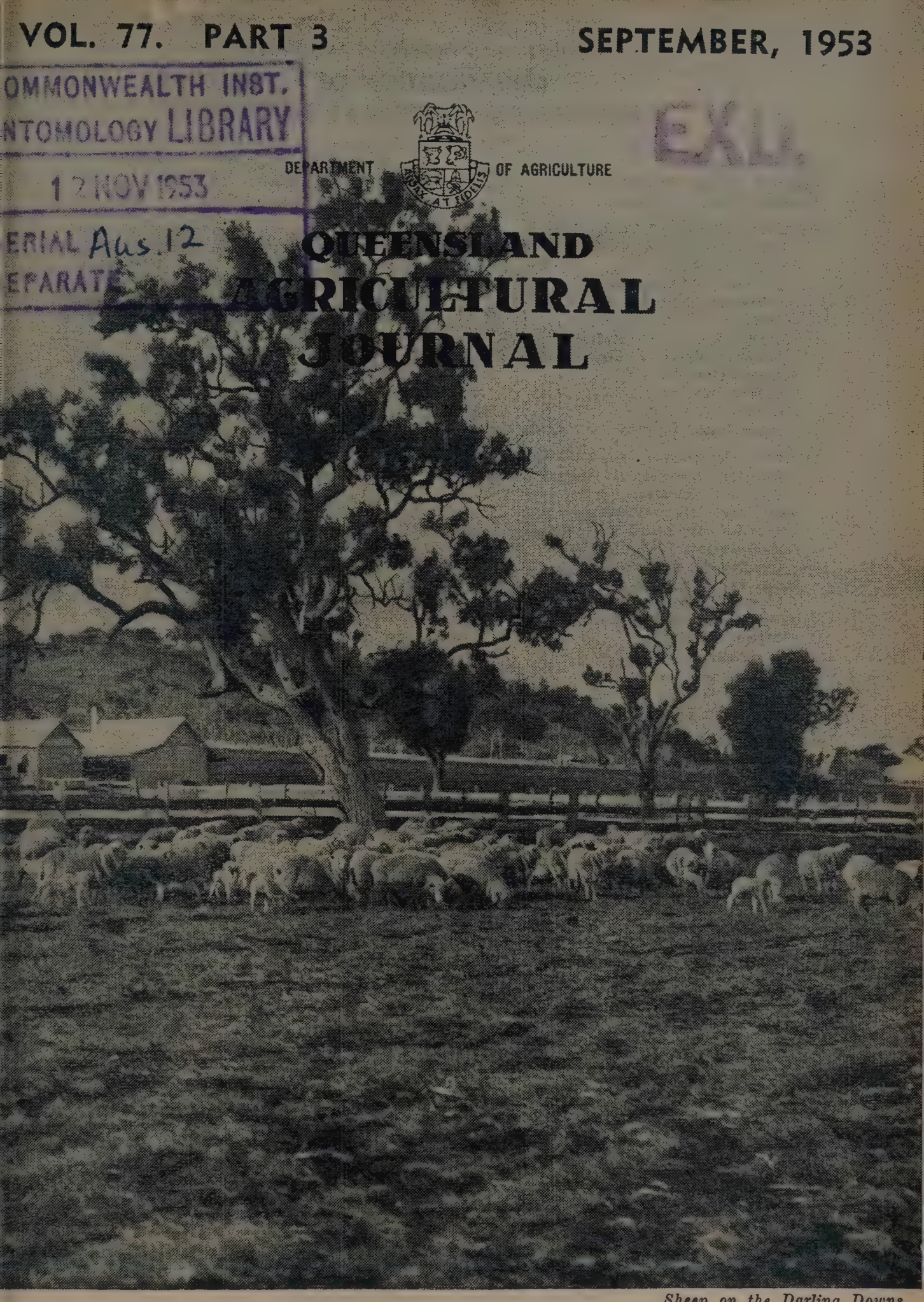
Saturn.—Now approaching the sun rapidly, will set between 8.30 p.m. and 10 p.m. at the beginning of September and between 6.30 p.m. and 8 p.m. at the end of the month.

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Potato Diseases
Indian Cattle
Stem Rot of Cowpeas

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The Pineapple.

P. MITCHELL (Senior Adviser in Horticulture) and R. C. CANNON (Senior Horticulturist).

(*Continued from page 84 of the August issue.*)

PLANTING.

When large and small plants are grown together, the larger plants develop more quickly than the smaller and tend to suppress them, thus accentuating any differences. Block planting of graded material results in greater uniformity within each section of the plantation. This is particularly important from the point of view of ease in harvesting, as it reduces the area to be covered at any one time.

Before planting, the material should be graded on the basis of thickness of the base and size of the leaf portion. A large, leafy plant with a small base has comparatively small food reserves, whereas a small, hard plant with a large base and little leaf would be slow to grow. As a general guide for grading, weight is a very useful criterion. It is not necessary to weigh every plant, but weights can be checked at intervals during grading to maintain the standard.

It is usually convenient to grade the plants on the site where they are to be planted. Sufficient plants for the whole area should be assembled before planting commences; otherwise there is likely to be unnecessary duplication of areas with the same grade of plants.

Spacing.

For many years, the double-row system of planting has been standard practice in Queensland. In this system, weeding is reduced to a minimum, for once the plants are sufficiently large to shade the spaces between the paired rows, weed growth is suppressed. At this stage, the plants also protect the soil surface from the hot rays of the sun during the summer months.

The two rows of each pair are usually 24 in. apart, and the double rows 6 ft. apart, centre to centre. This spacing permits movement along the rows during harvesting when the plants have spread out in the ratoon stage. In replant land, where growth is likely to be less

vigorous and where weeds are frequently more troublesome, it is often an advantage to reduce the spacing of double rows to 5 ft. 6 in. Within the rows, plants are normally spaced 12 in. apart, the positions of plants in adjacent rows being staggered. Crops planted with the double rows 6 ft. apart will require about 14,500 plants per acre, while at 5 ft. 6 in. centres, 15,800 plants will be needed.

Planting Methods.

Planting of tops, slips and suckers is usually done with a hand tool, such as a short-handled, narrow-bladed hoe. Plants should be set firmly but not too deeply; otherwise growth will be slow and the plants will be weak and spindly. Tops are planted to a depth of about 2 in., whilst slips and suckers are set 3½-4 in. in the ground, depending on their size. In the case of the suckers there is usually about an inch of dead tissue at the base; if this is not cut off before planting, it should be allowed for in determining the depth of planting.

Butts are planted in a furrow which is deep enough to allow a covering of about 4 in. of soil. They are laid horizontally, head to tail, in the furrow, which is then completely filled in. A cane dropper-planter is a very useful implement for the mechanical planting of butts. Care should be taken to ensure that the furrows are completely filled in without any depressions along the rows. Such depressions act as water channels and the soil may be scoured out round the plants during heavy rain, or water may accumulate around the base of the plants.

Where the rows are straight, a planting line, with markers 12 in. apart, is used to facilitate accurate spacing of plants in the row. The plants are laid out close to the line and planted on the side of it most convenient to the operator. The second row of the pair is then planted in the same way, with the plants in it opposite the spaces in the adjacent row.

When planting on the contour, the method of laying out the rows is somewhat different. The inter-row drains serve as a guide to the direction of the rows, and there are several methods of marking plant positions. A light wheel of suitable size, with spikes at intervals of 12 in. around its circumference, may be propelled along parallel to the inter-row drain, or a marking stick with a projecting arm and spike at its base may be used. In other cases, it may be convenient to use a planting hoe with a 12-in. handle which can be used to measure the distance between plants as they are being planted.

Planting through Paper Mulch.

Although not used extensively in Queensland, paper mulch has certain advantages. It keeps the soil warm, reduces evaporation losses and is useful in the control of weeds. The material is a light paper impregnated with a bitumastic preparation. It was originally available in rolls 3 ft. wide, but current stocks are only 2 ft. 6 in. wide, which is rather narrow for a standard 24-in. row spacing.

The paper is laid down on mounded beds and the plants dibbled through it. These beds are usually 3 ft. 3 in. wide and can be prepared quite easily by turning a plough furrow on to each side of the measured bed and then giving the surface an even camber with a rake or wide hoe. The land must be brought to a fine tilth and should be thoroughly moist before planting; otherwise soaking rain will be necessary before growth begins.

The free end of the roll of paper is firmly embedded in the soil at the end of a row and then unrolled on the surface, the edges being covered with about 3 in. of soil to keep them in position. A band of soil is also placed across the strip at intervals of half a chain or so. A still day is required for the work.

Planting through paper mulch requires some care. The paper is pierced with a trowel or a short-handled special tool with a flat blade 10 in. long by 3 in. wide and tapered to a point. The blade is forced through the paper into the soil and at the same time pulled forward. The plant is placed in the cavity behind the planting tool, which is gently withdrawn, leaving the plant in position. When planting tops, slips or suckers in paper mulch, the basal leaves must be stripped off to avoid damaging the paper.

FERTILIZING.

Very few pineapple crops are grown in Queensland without fertilizer. Virgin scrub soils of high natural fertility may produce good plant crops without fertilizer, but applications are usually needed in the ratoon crops.

Of the three major nutrients, pineapples require more nitrogen and potash than phosphoric acid. For general usage, a mixture known as 10-6-10, containing 10% nitrogen, 6% phosphoric acid and 10% potash, was devised many years ago and is still the standard fertilizer for pineapples in south-eastern Queensland. In view of the extremely high nitrogen requirement of the pineapple, it is usual to make alternate applications of the 10-6-10 mixture and sulphate of ammonia.

Placement of Fertilizer.

The placement of fertilizer in pineapples is peculiar to this crop. The fertilizer is applied directly to the base leaves of the plant rather than to the soil. Moisture from heavy dews and light rains is collected by the trough-like leaves and runs down to the bases of the leaves, where it dissolves some of the fertilizer lodged there and carries it down in solution to the roots near the base of the plant. In this way, the plant receives a more or less continuous supply of dissolved nutrients, even during relatively dry periods.

In the early stages of growth, while the plant is still small, application to the base leaves is impracticable and the fertilizer is applied directly to the soil adjacent to the young plants.

Methods of Application.

The fertilizer is usually applied to the base leaves by hand from a suitable container, such as a galvanized iron bucket. From about six inches above the ground, the fertilizer is thrown by a flick of the wrist so that most of it lodges on the base leaves and the balance falls to the ground near the plant. High placement is undesirable, for some of the fertilizer may reach the heart of the plant and burn the tender young leaves. Care and practice are necessary in this operation, and fertilizing on a windy day should be avoided.

When fertilizing newly planted tops or small slips, the back of the hand is placed against the lower leaves, which are raised by a slight pressure so that the operator can place the fertilizer close to the plant without risk of its reaching the growing point.

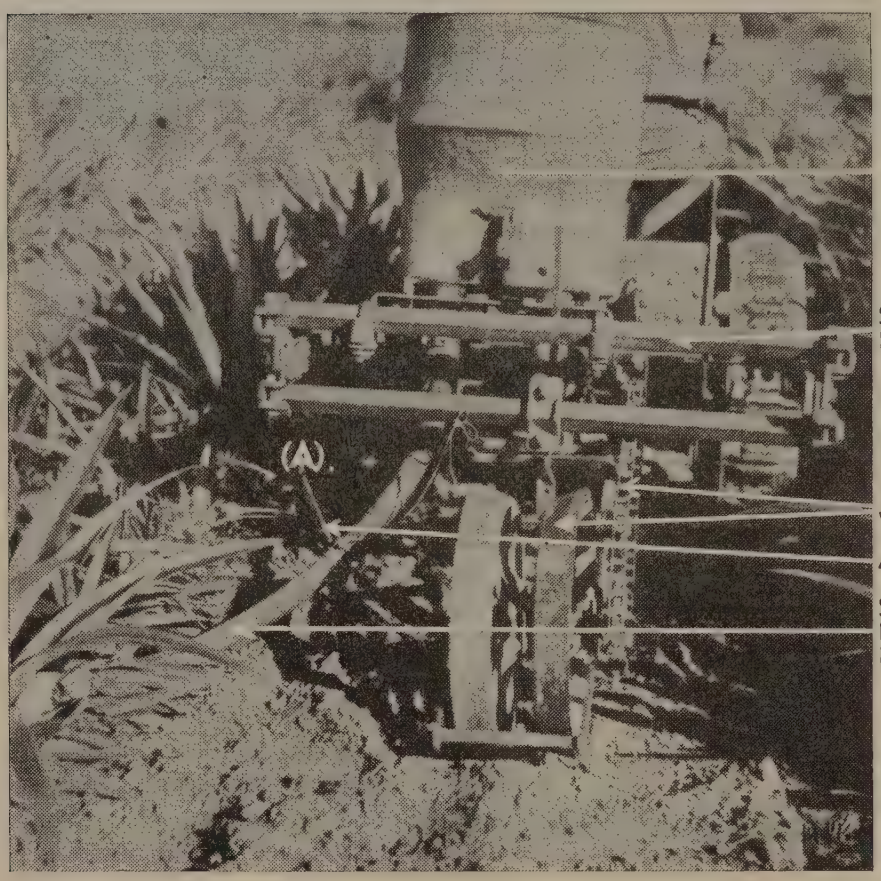


Plate 17.

Fertilizing Machine. Fertilizers are usually applied by hand, but some farmers have devised machines to do the work. One type is illustrated above.

In recent years several types of hand distributors have been developed for fertilizing pineapples. In addition, some larger units for the mechanical application of fertilizer to pineapples have been devised (Plate 17). These reduce the labour costs of the operation but tend to place the fertilizer in a band on the soil rather than directly into the base leaves. However, the speed of operation and the saving of labour may compensate for any loss of efficiency in placement.

Fertilizing Schedule.

As the cropping cycle of a pineapple plantation extends over several years, applications of fertilizer must be made to both plant and ratoon crops. Four applications are usually required each year. All are applied at periods when growth is in progress and the plants can utilize the nutrients supplied. The first application should be made within a few weeks of planting, when the plants have commenced to establish a root system. The actual time will depend on whether planting takes place in the autumn or the spring.

The spring application is usually made from September to early October. This is followed first by a midsummer application in December or January, and then by a late summer application in mid-March. The fourth application is made in early May before the crop enters the semi-dormant winter period, in which the intake of nutrients becomes negligible.

The following fertilizing schedule has proved effective under most conditions:—

Time.	Fertilizer.	Rate per Acre.	Rate per 1,000 plants.
		Lb.	Lb.
Sept.–Oct.	10–6–10	700	50
Dec.–Jan.	Sulphate of ammonia	420	30
Mid–March	10–6–10	700	50
Early May	Sulphate of ammonia	420	30

(50 lb. per 1,000 plants equals 1 large handful to 4 plants.)
(30 lb. per 1,000 plants equals 1 large handful to 6 plants.)

Fertilizer applications should not be postponed merely on account of dry weather, as a heavy dew or a light shower will dissolve some of the fertilizer from the leaf bases and carry it down to the roots.

With experience, nutritional deficiencies in the pineapple can be detected by eye and quickly corrected. A normal healthy plant is dark green in colour and has large broad leaves. Any departure from the normal colour and shape of the leaf is indicative of some form of malnutrition. If there is a deficiency of nitrogen the leaves assume a paler colour and may even become quite yellow, with only a tinge of green showing in the youngest leaves. If the plant is deficient in potash the leaves become brittle and stunted and lose most of the bloom on the under surface. In cases of severe malnutrition, the generally poor growth and stunted appearance of the plants are obvious symptoms of the need for fertilizer. The fertilizer schedule may be amended or supplemented on the basis of such deficiency symptoms when they are recognised.

TRACE ELEMENT DEFICIENCIES.

In addition to the major nutrients, in common with other plants pineapples require certain other elements in very small quantities. These are known as trace elements. In Queensland, two troubles due to trace element deficiencies—crookneck and iron chlorosis—occur in certain pineapple areas.

Crookneck.

Crookneck has been known on many sandy soils on the coastal plain since 1934. Typically, the leaves are very narrow, light green to yellow in colour and thickly waxed. In acute cases, the centre leaves bunch and bend over almost parallel to the ground, hence the name "crookneck".

The disorder is associated with a soil deficiency of the trace elements copper and zinc. It may be prevented or corrected by the inclusion of copper sulphate and zinc sulphate in the standard fertilizer. A "special" 10-6-10 mixture, containing 56 lb. each of copper sulphate and zinc sulphate per ton, is available and should be used for pineapple crops grown on soils where these deficiencies occur or are likely to occur. This mixture is more liable to burn the plants than 10-6-10 alone, and extra care is necessary in its application if damage is to be avoided.

Usually a single application of the mixture containing copper sulphate and zinc sulphate is sufficient to prevent crookneck. For obvious reasons, this mixture should be used for the first application after

planting. If this practice has not been followed and the disorder appears in a crop, an application of the special mixture will eventually restore growth to normal.

Crookneck is particularly common in the Wamuran-Caboolture-Beerwah area, but also occurs to a greater or smaller extent in many other districts. In the former area, the use of a special copper-zinc mixture after planting should be standard practice. In other areas its use is optional, but it is still a reasonable precaution to apply the special fertilizer, since the increased cost is not great.

Iron Chlorosis.

Iron is essential for the formation of the green colouring matter in the leaves, and a deficiency reduces the intensity of green colour in the plant. This is known as iron chlorosis. The typical symptom is a yellowing of the leaves, which is first apparent at the growing point. This latter characteristic usually serves to distinguish iron deficiency from nitrogen shortage, in which the youngest leaves usually show some green colour, while the older leaves are chlorotic.

Iron deficiency symptoms are due to a lack of available (or soluble) iron in the soil. They often appear on red soils which, though rich in iron, contain very little in an available form.

In some red soils, such as those of Mary Valley and Yeppoon, where the presence of excessive manganese reduces the availability of iron, chlorosis of the leaves is accompanied by a pronounced reddening of the skin colour of the fruit of affected plants. On these soils, a 3% solution of iron sulphate must be used as a foliage spray. This is prepared by dissolving 1 lb. of ferrous sulphate in $3\frac{1}{2}$ gall. of water and is applied as a fine mist over the plants. Excess spray or too high a concentration is liable to injure the foliage, and care is necessary when using it. Applications should be made at about monthly intervals throughout the growing period of the crop—that is, from September to April. Winter applications are not necessary.

WEED CONTROL.

Weeds compete with the pineapple plant for plant foods, moisture and light. On account of the shallow root system of the pineapple, deep inter-row cultivation is undesirable. Any weeds which appear in the crop should be eradicated when they are small. The removal of a dense stand of well-established weeds is not only harmful to the plants but is also a slow and costly process.

In recent years, chemical weedicides have been extensively used for weed control purposes, particularly before the weeds have emerged, although hand-hoeing is still practised to some extent.

Chemical Weed Control.

The materials used for weed control in pineapples (pentachlorophenol and sodium pentachlorophenate) are commonly known as PCP. These chemicals may be used safely at the recommended concentrations provided the spray does not reach the hearts of the plants in any quantity. When sprayed on to bare ground, PCP will effectively prevent the germination of weeds and grasses, but it gives only a temporary setback to established weeds and grasses. The addition of suitable oil emulsions, however, increases the toxicity of PCP sprays to large broad-leaved weeds, but grasses are relatively tolerant.

Forms of PCP.

Sodium pentachlorophenate is the most suitable form of PCP for use in sprays applied to bare ground (that is, pre-emergence sprays), since it is directly soluble in water to the extent of 25%. Pentachlorophenol, on the other hand, is insoluble in water but soluble in certain oils, which themselves have to be rendered miscible with water by the addition of suitable emulsifiers.

Pre-emergence Sprays.

For use as a pre-emergence weedicide, sodium pentachlorophenate is dissolved directly in water in the spray vat, and applied at a rate of 10-20 lb. per acre, irrespective of the quantity of water used. About 100 gall. per acre, applied to the bare surface of the ground as a fine mist spray, is usually sufficient for normal requirements (Plate 18). The only precaution necessary is to avoid spraying directly into the hearts of the plants; otherwise the growing points may be injured.

The best results are obtained when the ground is reasonably moist at the time of spraying. If the soil is so dry that weeds are not likely to germinate, it is usual to postpone spraying until rain has fallen. If, for any reason, dry soil must be treated, the quantity of water per acre should be increased. Heavy rain, even if it falls soon after spraying, does not lessen the efficiency of treatment.

The success of the pre-emergence weed control depends on the land being clean and free from growing weeds at the time of treatment. PCP applied under these conditions will keep land virtually free from weeds for a period of at least two months.

PCP-Emulsion Contact Sprays.

The only oils at present available in Queensland of interest in the pineapple crop are mineral oils of the diesel type and creosote. The former, when used alone, have virtually no effect on weeds at concentrations which are within the limits of safety for pineapples. Creosote emulsion is slightly more toxic to weeds at the safe concentration of 1 in 30, but not sufficiently so for it to be of any consequence in practice. The real importance of both lies in their use in combination with PCP.

Combination sprays of this kind, containing 3 lb. of PCP and 1 gall. of oil emulsion per 100 gall., give practically complete control of broad-leaved weeds. If the dominant weeds are grasses, the spray concentration may be increased to 6 lb. PCP and 2 gall. oil emulsion per 100 gall. This spray will destroy most weeds, and the surviving grasses are so severely checked that their removal by hand chipping is greatly facilitated, provided the work is done before recovery takes place.

For all practical purposes, the mineral oil emulsion is just as satisfactory as creosote emulsion for the control of broad-leaved weeds, but the latter is preferred if grasses are also involved. If grasses are not present in the crop, there is nothing to be gained by using higher concentrations than those specified.

In applying contact weedicides, it is important to completely wet the foliage of the weeds. The quantity required will, therefore, depend on the number and size of the weeds present, and no fixed rate per acre

can be prescribed. In most cases it will be considerably more than 100 gall. per acre, which is the amount normally required for pre-emergence treatment.



Plate 18.

Low Pressure Spray Unit for Applying Pentochlorophenol to the Pineapple Crop. Top, mounted tank with pump. Bottom, spray lines in operation.

Difficulty may be experienced in preparing PCP-oil emulsion sprays if hard water is used, more especially during drought periods, when the salt content of underground supplies tends to increase. Instead of mixing freely, the emulsion breaks, and free oil, or an oily scum, accumulates on the surface of the mixture. This not only blocks the jets, but also reduces the effectiveness of the spray. In order to overcome the trouble, the water may be treated with a proprietary water softener, such as "Calgon." The hardness of water does not materially affect its suitability for use with sodium pentachlorophenate in pre-emergence sprays, where oil emulsions are not included.

Of the two methods of chemical control, pre-emergence spraying is pre-eminently desirable, since the best way to control weeds is to prevent their establishment. Contact sprays are of value when the weeds have temporarily got out of hand.

Mechanical Weed Control.

The control of weeds by hand chipping requires no explanation beyond pointing out the desirability of working the hoe so that the loose soil is drawn towards the plants rather than away from them. If it is to be efficient, chipping must be done when the weeds are small, which necessitates frequent attention during the wet summer months. The frequency of chipping will naturally depend largely on weather conditions.

Flame-throwers are sometimes used for weed control. They do a good job against small weeds in young plantations and the cost of operation is low. In older plantations, where the amount of trash and dry leaves is greater, the fire hazard is considerable and flame-throwers can be used only in wet weather.

Where weed growth is out of hand, small motor mowers may be used to temporarily alleviate the position. This practice is sometimes useful in an emergency and may be successfully combined with spraying.

IRRIGATION.

During the period of most active growth, extending from early spring to autumn, the pineapple plant uses comparatively large amounts of water. In most parts of Queensland this requirement is usually met by the summer rainfall, but in the drier districts of the tropics particularly, irrigation is an advantage during spring and autumn. A 2-inch application each month should normally meet requirements in this area. In winter, when plant growth is slight, irrigation appears unnecessary; in summer, the rainfall is usually adequate for normal plant development.

CROP MANAGEMENT.

Good crop management aims at the maximum production of fruit per acre in the shortest period of time. Since the pineapple is a perennial plant, the whole cycle of plant and ratoon crops must be taken into account. The behaviour of the plant crop is, however, important, since it influences sucker production, on which the ratoon crop yields depend.

The best suckers are produced by a summer plant crop, in which they are usually fairly numerous, large, vigorous and low-set. Under natural conditions, most crops include some plants known as "hold-over" plants; each produces a medium-sized fruit which frequently falls over, and the suckers are borne 12-18 in. above the ground.

A winter plant crop, though the fruit may be large, usually produces relatively few suckers and its ratoons are less satisfactory. Hence, the first objective in plantation management is to ensure a uniform summer plant crop; if this is obtained a good first ratoon will follow automatically.

Control of cropping throughout the life of a plantation depends on the time of planting, the type of planting material used, and the treatment it receives. In southern Queensland, tops and butts take about 24 months to produce a crop, whereas slips and suckers fruit in about 18 months.

To obtain a summer crop, tops and butts should be planted in the autumn (from February to March), and slips or suckers in the spring, preferably during September. In the tropics, where temperature differences are not so great as in southern Queensland, suckering is not affected by seasonal factors to the same extent. In these areas, satisfactory results have been obtained by planting tops, slips or suckers from October to April, but butt planting should be restricted to the November-February period. If for any reason natural flowering does not take place, even though the plants are large enough to bear fruit, artificial flower induction may be practised on the backward plants. Flower induction at an earlier stage may also be applied to ensure a full summer crop.

Artificial Flower Induction.

A number of substances, such as smoke, acetylene and certain plant hormones, are known to induce flowering in pineapples. The first material to be used commercially was a solution of acetylene, but this has now been largely superseded by hormones, of which alpha-napthalene-acetic acid (ANA) is the best known.

ANA is available in tablet, powder and solution forms and is used at a dilution of 10 parts per million. This is obtained by dissolving the tablet or powder in water or diluting the solution according to the makers' directions. Acetylene solution is prepared by adding 5-6 fluid ounces of commercial calcium carbide to 4 gall. of water; acetylene is generated immediately and a saturated solution of the gas is available when bubbling has ceased.

Treatment consists in pouring into the heart of the plant about 2 fluid ounces of the ANA or acetylene solution. One gallon is sufficient to treat about 80 plants, which is roughly equivalent to 200 gall. per acre. On small areas, the solution may be applied from a small vessel with a spout, or with a knapsack spray from which the pump has been removed. For treating large areas, power sprays fitted with trigger releases, and with the spray nozzles removed, are quite efficient.

Artificial flower induction (or "gassing," as it is commonly called) has many applications in commercial pineapple production. There are, however, three main periods when it is most commonly applied in southern Queensland, namely:—

(1) *February to March*—to produce an early summer crop in November or December, when the markets are frequently under-supplied.

(2) *May*—to ensure uniformity of flowering in the plant crop.

(3) *September to early October*—to induce flowering in plants which failed to flower naturally in September. In this case, the normal summer crop of fruit will be followed by an intermediate crop from the gassed plants in May or June.

Flower induction can be of great value in the control of cropping, but treatment should be applied with discretion. The plants must be sufficiently large and vigorous to produce commercial fruit. That is, they should be comparable in size with plants which normally produce a satisfactory crop under natural conditions. Premature gassing (that is, the treatment of small plants) is liable to give a crop of under-sized fruit and suppress sucker development, with disastrous results on the ratoon crops. On the other hand, the judicious use of flower induction can often reduce the number of holdover plants and improve the yield during the life of the plantation.

Cropping Control.

Although a pineapple plantation will continue to bear fruit for many years, yields and fruit size decline with each succeeding ratoon crop. The rate of decline is influenced by a number of factors, but in practice it is seldom worth while retaining an area of pineapples beyond the second ratoon crop. By that time, irregularities in the stand resulting from variable vigour and disease are usually apparent, and the plants are so overgrown that efficient fertilizing and harvesting are almost impossible. In some cases it may be preferable to terminate the cropping cycle with the first ratoon crop.

Under average conditions, yields (tops on) are approximately:— Plant crop, 20 tons; 1st ratoon crop, 15 tons; 2nd ratoon crop, 10 tons. Yields substantially in excess of these figures have, however, been recorded in well-managed plantations during favourable seasons.

PLANTATION MANAGEMENT.

The aim of plantation management is continuity of production with a reasonably stable annual return to the grower. This can only be achieved by regular annual plantings to compensate for the areas which progressively go out of production and have to be destroyed. At the same time provision must be made to arrest any decline in soil fertility.

It is common experience on most soils that, in spite of heavy applications of artificial fertilizers, pineapple yields decline with each successive replanting. This is due to a natural decline in soil fertility, loss of soil structure and a steady build-up of pests and diseases. These factors may be modified by crop rotation and green manuring.

Maintenance of Soil Organic Matter.

Soil fertility is not simply a measure of the amount of plant food in the soil. It also involves its tilth or physical condition, which regulates the supply of air and water to the plant and influences the activity of organisms which play an important part in making nutrients available to the plant. Soil structure depends a great deal on the amount of organic matter present and soil management is consequently largely the practice of replacing the organic matter lost during cropping.

In the pineapple plantation where weeds are suppressed, the organic matter present in the soil is rapidly destroyed by exposure to the sun. In practice, organic matter may be supplied from the pineapple crop residues which remain when an area is broken up, by ploughing under green manure crops during the intercycle period, or by a combination of both.

The value of such material depends on its eventual decomposition and incorporation in the soil. Old pineapple plants are very bulky and if left whole take a long time to disintegrate. It is therefore desirable to hasten the process by breaking up and shredding the material. This operation should be carried out while the plants are still succulent, as they are more difficult to handle when they become dry and tough. The rotary hoe is a popular implement for this purpose, but if improperly used it pulverises the soil, so it should be set to work as near the surface as possible. Portable chaffcutters are sometimes used to shred the crop residues, but this practice entails a considerable amount of hand work and is rather laborious. Overseas, gangs of heavy, multiple serrated-disc harrows drawn by powerful tractors are used to break up old pineapple areas, but the smaller plantations and steep slopes in many parts of southern Queensland preclude the use of such heavy equipment. Smaller cutaway disc harrows might be more adaptable to local conditions.

Crop Rotation.

Where one crop is grown continuously, pest and disease organisms tend to multiply. A rotation of crops has the opposite effect, and when a green manure forms part of the rotation a considerable amount of organic matter is regularly added to the soil.

A number of green manures have proved satisfactory in Queensland. Of the annual crops, the Poona, Cristaudo, Reeves and Giant varieties of cowpea, and velvet beans, have been used in summer, and New Zealand blue lupin in winter. Of the perennial crops, pigeon pea (Plate 19) may be useful but there is still some doubt as to its value where certain species of nematodes are a factor in production.



Plate 19.

Pigeon Pea, a Leguminous Cover Crop Grown during the Intercycle Period on the North Coast.

The optimum intercycle period between successive crops of pineapples is probably about 13 months. This permits two summer crops of a summer legume and one winter crop of lupins, or alternatively a single sowing of a perennial. In either case, the old pineapple trash should first be fairly well shredded and worked into the soil before the legume is sown. Typical sowing rates are:—cowpeas, ¾ bushel per acre; New Zealand blue lupin, ¾ bushel per acre; and pigeon pea 20 lb. per acre. The green manure should be ploughed under at least six weeks before the following crop is planted, to allow time for the material to rot down.

Cropping Units.

The area planted to pineapples each year on any farm will be governed by the annual production desired, the commercial life of an area and the particular rotation system followed. For average conditions, the total cropping area may be subdivided into 6 units of equal area, as follows:—

(1) Young plants not yet in bearing.
(2) Plant crop in bearing.
(3) First ratoon crop.
(4) Second ratoon crop.
(5) Under green crop.
(6) Area in course of preparation for planting.

If the size of each unit is 2 acres, the total cropping area would be 12 acres, with 6 acres bearing each year.

HARVESTING.

Pineapple fruit must be placed on the market in good condition and at the right stage of maturity. Several precautions are necessary in the summer months to protect the maturing fruit from sunburn, which can sometimes account for considerable losses.

Protection from Sunburn.

Although the top and surrounding suckers and slips afford some protection to the fruit, this is not always adequate, especially if the fruit is not very low-set on the plant. Fruit which leans or has fallen over is particularly prone to severe sunburning.

It is, therefore, a wise precaution to go through the plantation early in the summer and to cover any fruit which is unduly exposed. For this purpose brown paper sleeves are quite effective; they may be slipped on the fruit over an inverted funnel of suitable size. When harvesting, the bottom end of the sleeve is raised slightly to expose the base of the fruit so that its stage of maturity can be determined. Alternatively, woodwool may be lightly wrapped round the exposed portions of the fruit. In this case, the stage of maturity can usually be observed without removing the woodwool. Most of this material can be salvaged for further use. In windy weather it is advisable to go through the plantation at regular intervals and replace any covers which may have become dislodged.

Harvesting for Fresh Fruit Markets.

Pineapples for fresh fruit markets should be harvested at the stage of maturity suitable for the particular market (Plate 20). This will be influenced by the distance of the market, less mature fruit being packed

as the distance increases. Since the appearance of fruit is important in the fresh fruit market, malformed fruit or fruit bearing multiple tops or basal knobs should be rejected in the packing shed. Very large fruit is also usually not very acceptable to fresh fruit markets.



Plate 20.

Fruit for Special and Export Packs. The fruit is cut from the plant and protected with woodwool.

Harvesting Cannery Fruit.

Since cannery fruit is processed within a relatively short time after harvesting, it may, and should, show more colour than fruit which has to travel a long distance to fresh fruit markets. In this case, the tops are removed before packing and misshapen tops are of less importance. Fruit which is not sufficiently attractive in appearance for a fresh fruit market may be still quite suitable for canning. This does not mean, however, that the cannery can serve as a dumping ground for all inferior fruit; the quality of the canned product is largely governed by the quality of the fruit processed.

Handling of Fruit.

The pineapple fruit is very susceptible to bruising and should therefore be handled with great care. Bruising permits the easy entry of organisms responsible for fruit rots, in particular water blister. Although bruised fruit may be quite sound when it leaves the plantation, it may be a rotten mass by the time it reaches its destination.

As a rule, fruit is harvested into baskets and carried out to the ends of the rows, where it is transferred into lug boxes, crates, trailers, trucks or slides, as the case may be. Careless handling at this point is often responsible for considerable bruising and ultimate losses.

Packing Shed Hygiene.

Apart from being untidy, an accumulation of tops and trimmings in the vicinity of the packing shed is an ideal breeding ground for the water blister fungus. Hence, all such material should be regularly and frequently removed at least 200 yards away. Tops which are valuable planting material should be dealt with promptly and stored as already described.

As an additional precaution, the building, cases and other equipment should be sprayed with a 2% solution of formalin, preferably prior to each harvest.

PLANT PROTECTION

Stem Rot of Cowpeas.

G. S. PURSS, Assistant Pathologist, Science Branch.

IN the past, cowpeas in southern Queensland have been singularly free from serious diseases. However, early in 1952, following on the discovery of stem rot in North Queensland, severe outbreaks of this disease were reported from cowpea crops in the Fassifern and Lockyer Valleys, the Darling Downs, and in districts surrounding Gympie and Kilcoy. This disease recurred in the 1952-53 season, causing considerable damage in many areas.

Cowpeas in Queensland perform two valuable functions. In localities where soils are naturally rather poor, their use as a cover crop to increase soil fertility is widespread. This crop also provides valuable summer grazing for stock, particularly dairy herds. The disease now threatens to limit the use of this crop, especially the widely grown Poona variety, and unless some measure of control is introduced, a very useful soil-building and grazing crop may be lost to farmers and dairymen.



Plate 1.

A Crop of the Poona Variety Infected with Stem Rot.

Symptoms.

Isolated yellowing patches occurring within a field of cowpeas are usually the first indication that the disease is present. Under favourable weather conditions these patches rapidly expand, and eventually all the field may be involved. It is not uncommon to find a 100 per cent. infection of individual plants in such cases. If conditions remain moist, the diseased plants may survive for a considerable time, but in dry weather there is a rapid wilting followed by dropping of leaves and death (Plate 1).

Close examination of an affected plant reveals a diseased area, usually light brown in colour, completely girdling the base of the stem. The area of decay often extends well up the stem and may even embrace the tip. The tissue immediately in advance of this usually



Plate 2.

Typical Stem Rot Symptoms on the Base of Cowpea Plants.

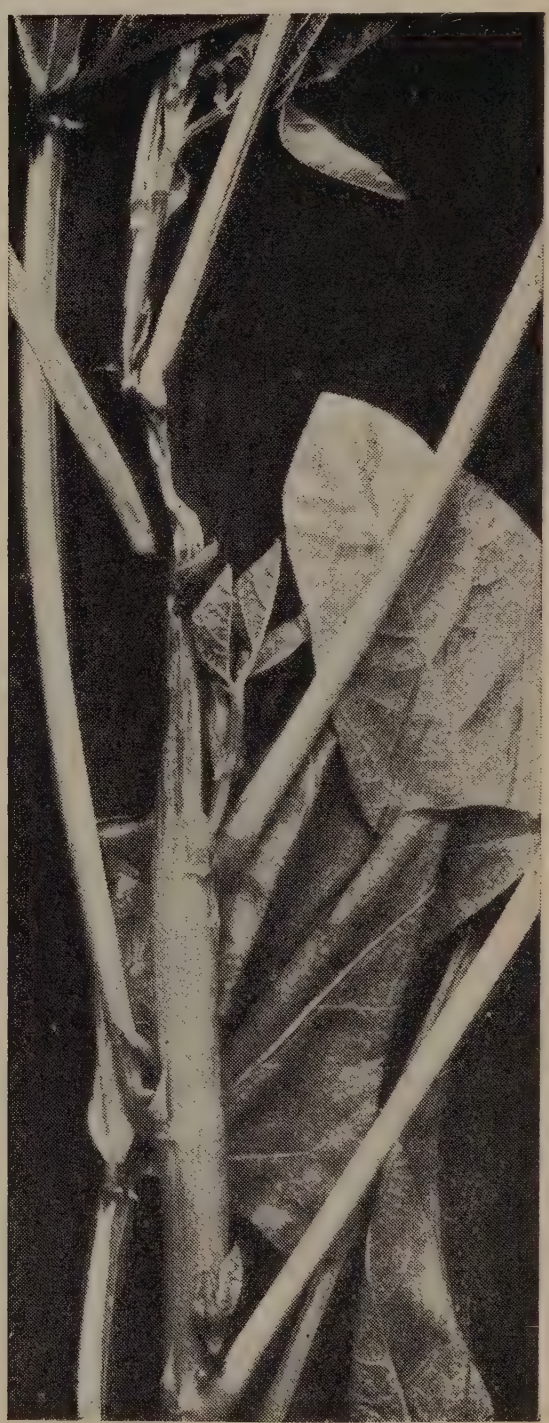


Plate 3.

Stem Decay Resulting from Aerial Infection.

has a "water-soaked" appearance. The root system is invariably quite dead and often covered with a mass of pink and white spores (Plate 2). The fibrous tissue of the stem for a short distance ahead of the decay is often discoloured brown, but this is not a constant feature.

Under very moist conditions the upper part of the plant may be attacked direct, without any connection with rotting nearer the ground, and a withering and collapse of the stem tissue is produced (Plate 3).

The disease attacks plants at all stages of development, with crops approaching flowering most commonly affected. Plants in the seedling stage are often attacked, particularly when grown on soil which has carried an infected crop during the previous season. In this case symptoms are similar but on a rather reduced scale.

Cause and Spread of the Disease.

The disease is caused by a fungus, a species of *Phytophthora*. Sufficient evidence has been accumulated to show that this fungus is definitely soil-borne and capable of living there for at least two years.

Evidence would also indicate that the fungus may move in the soil through agencies such as free soil moisture. It is likely to be transferred between paddocks on cultivation implements or on the hooves of grazing animals. Considerable spread in the field under very moist conditions by aerial spores is a distinct possibility.

There is no evidence to suggest that the disease is seed-borne but this possibility has not been completely eliminated.

Control.

Control of the disease offers a difficult problem. The two varieties commonly grown in southern Queensland, Poona and Reeves, are completely susceptible to the disease. Once infected, a paddock is not suitable for further crops of susceptible cowpea varieties for at least two seasons. This period may, as knowledge of the disease increases, prove to be a much longer one.

Crop rotation is a method often used to control this type of disease. Where it is practicable, growers should avoid planting successive crops of cowpeas on the same land. In many areas, however, the use of a summer grazing or cover crop is desirable every year, and as there is at present no satisfactory substitute for cowpeas, crop rotation is not an entirely satisfactory method of controlling stem rot where suitable land is limited.

The use of varieties resistant to the disease is the only real answer to the problem. During the past two years numerous varieties, comprising most of those available, have been tested with a view to finding resistant types.

The variety Cristaudo, commonly grown as a cover crop in northern sugar-growing areas, possesses a high degree of resistance to the disease (Plate 4). It is a somewhat later variety than Poona or Reeves. Under good seasonal conditions it gives an excellent cover and has also shown promise as a grazing cowpea.



Plate 4.

The Cristaudo Variety of Cowpea Growing on Infected Soil.

Another northern variety, Giant, also appears to possess a fair degree of resistance. This is a somewhat coarser growing type which would not be as suitable as Poona for grazing. It is also rather late-maturing but provides an excellent cover.

Although these varieties may not be as acceptable for general use as the Poona pea type, they are well worth considering where this variety cannot be grown because of the ravages of stem rot. A further search is being made amongst promising introduced varieties and local strains with the object of obtaining a cowpea satisfactory in all respects and completely resistant to the disease.

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Diseases of Potatoes.

R. B. MORWOOD (Formerly Senior Pathologist, Science Branch).

POTATO diseases are caused by the action of parasitic fungi and bacteria and by infectious viruses. There are also a number of disorders, known as physiological diseases, which are due to unsuitable conditions of growth or storage. The diseases occurring in Queensland are discussed in the following pages.

IRISH BLIGHT.

Irish blight is capable of causing the most devastating effect on a crop when no adequate control measures are adopted and conditions favour the disease. It is first recognised as black spots on the leaves. These spots may be dried out by the sun, or may spread to involve all the leaf tissue, the leaf stalks, and finally the stem (Plate 1). When the stem is severely attacked the plant dies right down to the ground.



Plate 1.

Irish Blight. Foliage symptoms.

The tubers, if present, may be affected either by the disease spreading down through the underground stems or by direct infection of exposed surfaces before or after digging. The tuber symptoms consist of a sunken and darkened skin, beneath which are areas of brown tissue extending to varying depths into the potato (Plate 2). Under moist conditions of storage the tubers may rot away completely.



Plate 2.
Irish Blight. Tuber symptoms.

The disease is caused by a fungus (*Phytophthora infestans*), which in moist weather produces spores on the surface of the black spots just described. The spore-producing portion can be seen with the unaided eye as a delicate white down. It is these spores which spread the disease throughout a crop.

In addition to moisture, temperature is an important factor in the development and spread of this disease. It is one of the diseases which are favoured by cold weather. In southern Queensland, two crops of potatoes are normally grown, one in the spring and the other in the autumn. Irish blight is liable to be serious in the colder months of these two growing periods—that is, early in the development of the spring crop and late in the development of the autumn crop. The disease seldom occurs in the more northern potato-growing districts.

Plant breeders have been working towards the development of potato varieties resistant to Irish blight and there are now available a number of good commercial varieties with field resistance to this disease. These include Sebago, Exton, Sequoia, Monak and Adina. If one of these is used there is normally no need for spraying with a fungicide.

Control.

(1) Grow resistant varieties.

(2) Use certified seed and practice a rotation of crops so as to avoid having a source of the fungus in the field.

(3) If for any reason a susceptible variety is grown, spray with Bordeaux mixture (4-4-40) or another suitable copper spray when conditions favour the disease—that is, during cold, showery weather. Repeat the spray application at intervals of 10-14 days, three to five times. A copper dust may be used instead of the spray but it should be applied more frequently. The amount of spray required will vary from 100 to 150 gallons per acre per application, while the amount of dust will be approximately 20 lb.

TARGET SPOT.

Like Irish blight, target spot (*Alternaria solani*) also causes leaf spotting. The spots, however, are somewhat smaller, with more definite margins, and frequently show concentric markings resembling a target (Plates 3 and 4). The disease is not confined to cool weather, and



Plate 3.
Target Spot. Foliage symptoms.

provided there is adequate moisture in the air, it can develop during the summer months. However, in southern Queensland it reaches the peak of its development towards the end of the autumn. In northern Queensland, where potatoes are planted in April to May and harvested in early spring, target spot is probably the most serious potato disease.

While its effect on the plant is not so spectacular as in a severe attack of Irish blight, it can in some circumstances cause severe crop losses. A lightly infected earlier crop with comparatively few spots



Plate 4.
Target Spot. General appearance.

may produce sufficient spores to seriously infect a late crop grown nearby. In such circumstances the amount of infected material builds up till the disease may completely defoliate the late crop. This explains the incidence of severe disease towards the end of the growing season.

Control.

(1) Avoid successive potato crops in adjacent areas.

(2) Spray with Bordeaux mixture or other suitable copper spray at the flowering period.

(3) Repeat the spray two to four times at intervals of 10-14 days. A copper dust may be substituted for the spray but it should be applied more often.

FUSARIUM WILT AND DRY ROT.

Fusarium wilt in the field is typified by the drooping of individual plants as though they lacked water. On cutting the stem of an affected plant lengthways at ground level, it will be seen to have running along it a number of internal brown streaks corresponding with the water-conducting vessels of the plant. A tuber rot may also occur as an irregular, dry, brown rot with obvious patches of white or slightly coloured mould either on the surface or in internal spaces in the tuber.

The diseases are caused by closely related fungi, the wilt in the field being due to one species (*Fusarium oxysporum*) and the tuber rot to it and a number of other species.



Plate 5.
Bacterial Wilt. Foliage symptoms.



Plate 6.
Bacterial Wilt. Tuber symptoms.

Control.

The control of the tuber rot consists of bagging only sound healthy tubers and careful digging and handling to avoid injury to the skin of the potato. The wilt of the plant is generally confined to a small percentage of the crop and no specific control measures are required except rotation of crops.

SCLEROTIAL STEM ROT.

The potato, in common with many other crops, is liable to infection with the fungus *Sclerotium rolfsii,* which produces a rot of the stem at about ground level. The fungus can be seen as a white mould on the surface of the soil and on the plant. It produces resting bodies about the size of radish seed, which remain in the soil and carry the disease over from season to season. Rotation of crops is the only feasible control measure.

POWDERY MILDEW.

A white superficial fungous growth on leaves and stems of potatoes can sometimes be seen on otherwise healthy plants. This consists of a parasitic fungus allied to the powdery mildew of pumpkins and many other plants. Control measures are seldom warranted on potatoes, but when necessary the use of sulphur is recommended.

BACTERIAL DISEASES—BACTERIAL WILT AND BLACKLEG.

Bacterial wilt resembles Fusarium wilt in its general effect, but the internal symptoms are different (Plate 5). The water-conducting vessels are not turned brown, but they are filled with bacteria which appear, on cutting the stem, as drops of ooze on the cut surface. The tuber exhibits a wet rot which under moist conditions in a bag spreads rapidly and destroys the whole tuber, then spreading to neighbouring potatoes (Plate 6). The disease is caused by a bacterium (*Pseudomonas solanacearum*). It is of somewhat frequent occurrence on coastal river flats but is usually responsible for the loss of only a small percentage of the crop.

The most conspicuous feature of the bacterial disease known as blackleg, which is caused by *Erwinia atroseptica,* is a soft black rot of the stem about ground level. The tops above the affected area wilt. The tubers are affected by a soft rot similar to that of bacterial wilt.

Control.

Control of the bacterial diseases consists of rotation of crops, care in selecting seed to use only sound tubers, and good storage conditions for all tubers, but especially those to be used for seed. In the case of blackleg, treatment of the seed to destroy surface-borne organisms has been shown to be of some benefit. The methods used in treating seed are discussed later in connection with scab.

[TO BE CONTINUED].

Onion Thrips in the Lockyer District.

T. PASSLOW, Assistant Entomologist, Science Branch.

ONIONS and related crops in the Lockyer district are usually infested with thrips (*Thrips tabaci* Lind.), which, by causing serious injury to the growing plants, may reduce yields of bulbs and seed.



Plate 1.

Symptoms of Thrips Injury to Maturing Onion Leaves.

The immature onion thrips is a small, creamy-yellow, elongate insect which lives and feeds within the shelter of the leaf bases until the prepupal stage is reached, when it moves to the soil and pupates. On emergence the adults return to the plants to feed and deposit eggs, the entire cycle from eggs to adults taking up to a month. The mature insect is darker than the immature stages, about one-twelfth of an inch in length, and carries two pairs of narrow fringed wings. Although called the onion thrips it may be found on a wide variety of plants, including numerous weeds.

Thrips feed by rasping the tissues and extracting sap, and large numbers can cause severe injury and even kill onion plants. The bulk of feeding occurs on the newly formed leaves, and as these grow the feeding punctures expand and elongate to give the typical symptoms of onion thrips activity—small whitish spots and streaks. Following intensive pest activity the leaves present a silvery-white stippled appearance as they age (Plate 1).

In crops grown for seed, the thrips feed on the leaves until the flower heads commence to open, and then move up the flower stems to feed on the stalks of the florets. This may interfere with normal seed production.

Seasonal conditions are important factors influencing thrips numbers, and the pests breed most rapidly when a mild, dry winter is followed by a hot, dry spring. Damage may then be severe, particularly in mid-season and late-maturing crops. Usually, however, winter temperatures experienced in the Lockyer district restrict thrips breeding and the early crops are harvested during spring before appreciable plant injury occurs.

Thrips damage is also dependent to a certain extent on the vigour of the plants. Onions grown under poor conditions have not the same ability to withstand the ravages of the pests, and appear to carry larger numbers of thrips than those crops given better conditions.

With adequate irrigation and sound farming methods to ensure continuous rapid growth, onions can be produced profitably despite the presence of thrips. Under these conditions the application of suitable insecticides will not appreciably increase yields in either bulb or seed crops.

Chemical Control.

Some of the modern insecticides are more effective for killing thrips than the older materials such as nicotine sulphate, tartar emetic and derris. The most economical at present is DDT emulsion, applied at ½ lb. of active ingredient per acre (for example, 0·1% spray at 50 gallons per acre). Adjustments in the dilutions will depend on the outputs per acre of the spray units used. With knapsacks, 100 gallons is the most suitable rate per acre.

When numbers exceed 15 mature thrips per plant, spray treatments should be applied, and if breeding is intensive, treatments may be necessary at fortnightly intervals. For seed crops up to nine applications may be required, continuing until the seed is set. Spray treatments during flowering do not adversely affect pollination or impair the germination of the seed.

Insecticide control will seldom be necessary in other than non-irrigated onions.



The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

(*Continued from page* 101 *of the August issue.*)

Red Stringybark.

Botanical Name.—*Eucalyptus resinifera* Sm.

Other Common Names.—Red mahogany, red messmate, Jimmy Low, forest mahogany.

Distinguishing Features.—A stringybark (Plates 32-34) with a somewhat flaky bark approaching that of a bloodwood at first sight, with leaves distinctly paler on the lower surface, rather long stalks



Plate 32.

Red Stringybark (Eucalyptus resinifera). Portion of trunk.

to the flowers and capsules, buds with very long lids and somewhat cup-shaped capsules with stout, projecting valves.

Description: A tall tree up to 100 ft. or more high, with grey, thick, closely packed bark with a slightly furrowed surface that can be pulled away in long strips to expose a reddish inner bark. The leaves are spreading, with a dark green upper surface and a much paler lower surface; they taper to a sharp point and are about 5–7 times as long as wide and about 3½–4½ in. long. The flowers are carried in stalked bunches among the leaves and at the ends of the twigs. Each flower is nearly ½ in. wide and has a stalk about ⅕ to ⅓ in. long. The lid of the bud is about ½ in. long, about 3 times or more as long as the rest of the bud. The capsule has stout projecting tooth-like valves; excluding these valves it resembles in shape an egg with the narrow end downwards, about ⅓ in. long and nearly as wide; sometimes it is nearly cup-shaped.

Distribution.—Chiefly in Moreton and Wide Bay Districts, on sandy or stony soil with other eucalypts. It extends along the coast into North Queensland and south to about Sydney.



Plate 33.

Red Stringybark (Eucalyptus resinifera). Left, branchlet with leaves and seed-capsules. Right, branchlet with leaves and buds.

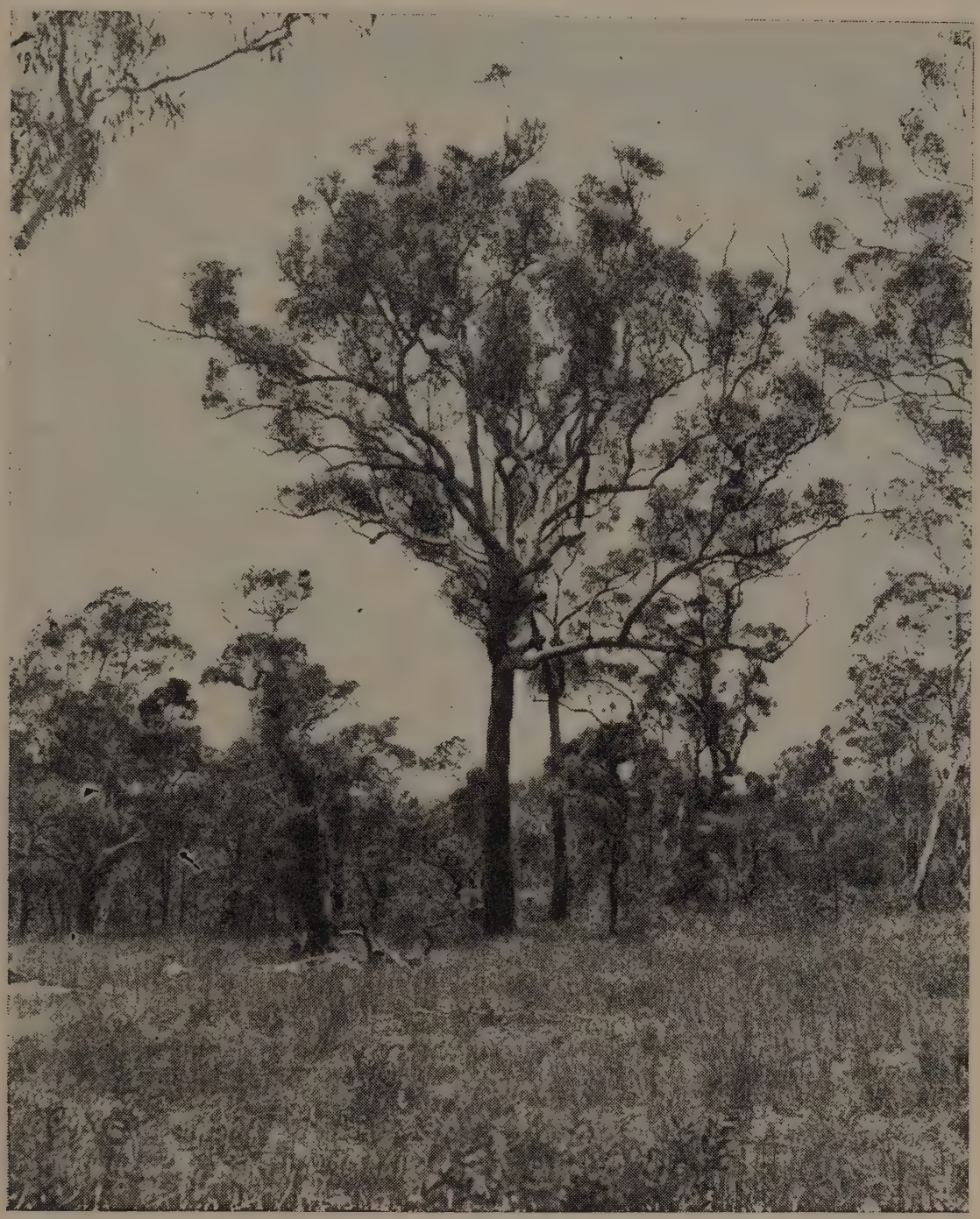


Plate 34.

Red Stringybark (Eucalyptus resinifera). Caloundra district.

Usual Flowering Time.—November to February.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Major.

General Remarks.—This is another good supporting species, as large supplies of pollen and a fair amount of honey are obtained about every second season. The crop is usually in the form of a natural blend with honey from several other species. In some favourable seasons the sharp flavour of red stringybark honey is dominant in such blends but generally it is detected only as a background flavour. Those who acquire the taste for red stringybark honey prefer it, irrespective of the dark appearance and weak density.

Care must be exercised in heating honey which is predominantly from red stringybark, as a layer of froth will be found on top of the heated product some time after it is tinned. This can be avoided by "flash" heating to 160 deg. F. Another feature is that this honey does not granulate readily.

Yellow Stringybark.

Botanical Name.—*Eucalyptus acmenioides* Schau., sometimes known as *Eucalyptus triantha* Link.

Other Common Names.—Yellow or white mahogany, yellow jacket, white stringybark.

Distinguishing Features.—A stringybark (Plates 35-36) with leaves distinctly paler on the lower surface, short but distinct stalks to the flowers and capsules, buds with lids about as long as the lower part of the bud, and cup-shaped capsules with the valves scarcely prominent.

Description.—A tree to about 100 ft. high, with a rather dense crown and grey thick bark that can be pulled away in long strips showing the brown inner bark. The leaves usually spread out from the twigs, taper to a sharp point, and are sometimes slightly curved or with one side slightly shorter than the other at the base; they are



Plate 35.

Yellow Stringybark (Eucalyptus acmenioides). Branchlets with leaves, flower buds and seed-capsules.

much paler on the under surface, mostly 3-6 in. long and 5-8 times as long as wide. The flowers are carried in bunches at the ends of the twigs and in a few smaller ones among the leaves; they are about $\frac{3}{8}$ in. wide and have distinct stalks. The bud has a pointed lid about as long as the rest of the bud. The capsules are somewhat rounded or nearly hemispherical, about $\frac{1}{5}$ in. long and wide.

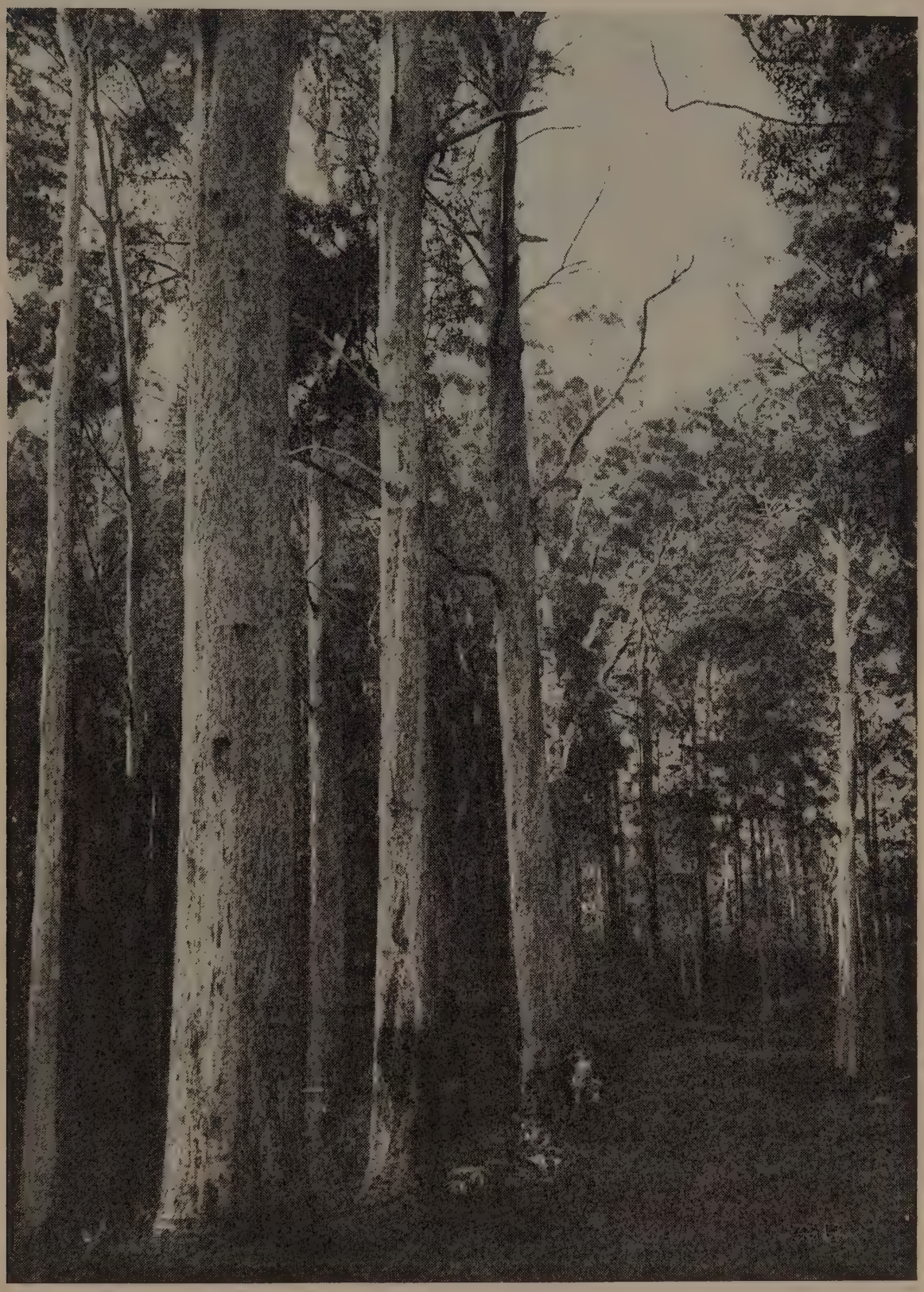


Plate 36.

Yellow Stringybark (Eucalyptus acmenioides). Swain Peak, near Eumundi.

[*Photograph by Forestry Sub-Department.*

Distribution.—In forest country in south-eastern Queensland, often on stony hillsides, sometimes near the edges of "scrub." It occurs along coastal and sub-coastal Queensland to the Atherton Tableland and into New South Wales as far south as Sydney.

Note.—There is another stringybark (*Eucalyptus umbra* R. T. Baker, also known as *Eucalyptus carnea* R. T. Baker) which closely resembles *Eucalyptus acmenioides* and is known by the same common names. It can be distinguished by the leaves, which are more drooping and thicker, not so sharply pointed, and not paler on the lower surface or only very slightly so; the capsules often have thicker walls and are sometimes slightly larger (Plates 37-38). It is found in forest country in the Moreton and Wide Bay Districts, extending north to the Atherton Tableland and south almost as far as Sydney.



Plate 37.

Yellow Stringybark (Eucalyptus umbra). Branchlets with leaves, buds, flowers and seed-capsules.



Plate 38.

Yellow Stringybark (Eucalyptus umbra). Sunnybank.

Usual Flowering Time.—October to December.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Major.

General Remarks.—This tree is valuable to the beekeeper as a supporting species which yields large supplies of pollen and a moderate quantity of nectar practically every season. In addition, it flowers often in conjunction with the excellent nectar-producing grey ironbark. The ample pollen provided by yellow stringybark results in the pollen-deficient grey ironbark being worked more effectively and without impairment of colony strength.

The honey obtained from this stringybark tends to darken any honey with which it is naturally blended. In a grey ironbark-yellow stringybark blend, however, this tendency is not sufficient to lower the grading of the choicer grey ironbark honey. Like all stringybark honeys the flavour is sharp, the density weak, and a considerable amount of froth is thrown off when heated.

Beekeepers seeking grey ironbark sites prefer areas in which yellow stringybark is also present.

Honey from *E. umbra* exhibits similar characteristics to those described for *E. acmenioides,* although the tree is of only minor importance as a nectar and pollen producer.

White Stringybark.

Botanical Name.—Eucalyptus phaeotricha Blakely & McKie. In the past this species has been frequently called *Eucalyptus eugenioides* Sieb. ex Spreng., but this name properly belongs to a different tree of the Sydney district.

Other Common Names.—Grey stringybark, brown stringybark, Queensland stringybark, pink blackbutt.

Distinguishing Features.—A stringybark (Plates 39-41) with a somewhat silvery sheen to the foliage as a whole; thick-walled capsules shorter than wide, in close clusters.

Description.—A tree up to 100 ft. or more high, with grey, thick, closely packed bark that can be pulled away in long strips. The smaller branches are often smooth. The leaves often appear somewhat silvery from a short distance and hang vertically; they are curved, between 3 and 5 times as long as wide, mostly about 3-4 in. long, gradually narrowed to a pointed tip and with one side shorter than the other at the base. The flowers are borne in stalked clusters among the leaves towards the ends of the twigs and are nearly ½ in. wide when fully out;



Plate 39.

White Stringybark (Eucalyptus phaeotricha). Left to right, leaves, seed-capsules, coppice leaf and flower-buds.

the lid is rounded and much shorter than the rest of the bud. The seed-capsules are in clusters along the branches below the leaves, with hardly any visible stalk of their own, broader than long, with rounded sides and a relatively small opening, mostly about $\frac{1}{4}$ in. high and about $\frac{1}{3}$ in. wide; the four valves usually project a little beyond the opening.

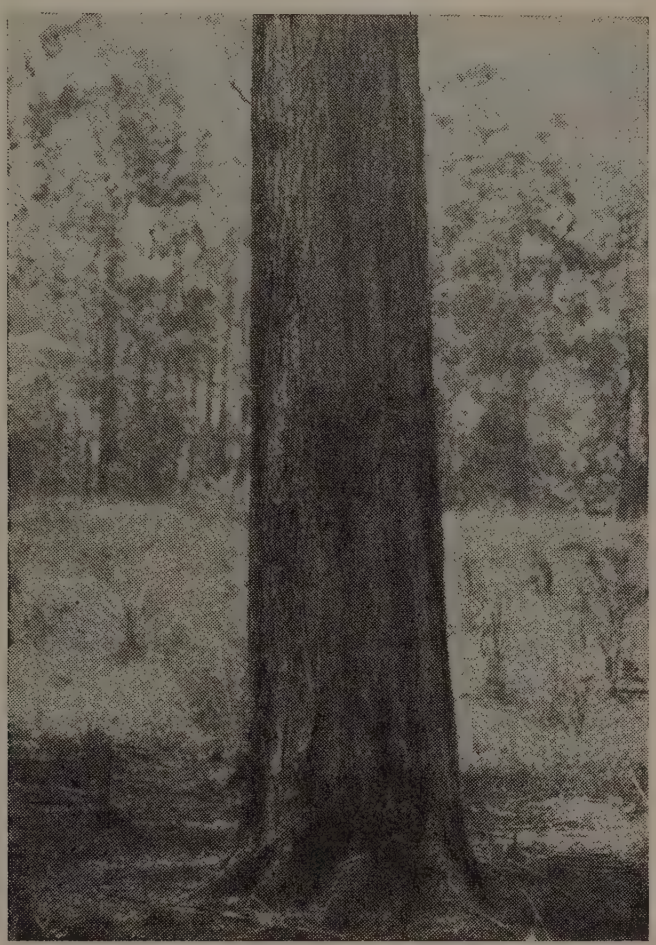


Plate 40.

White Stringybark (Eucalyptus phaeotricha). Portion of trunk.

Distribution.—Moreton and Wide Bay Districts, in forest country with other eucalypts, chiefly on stony or sandy soil. Known also from North Queensland.

Note: In the Granite Belt other stringybarks occur, most of them difficult to distinguish from one another and from *Eucalyptus phaeotricha.*

Usual Flowering Time.—February to April.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Minor.

General Remarks.—Although this species flowers practically every year, little return in the form of pollen or nectar is obtained.

White stringybark is worked vigorously, more so than most other trees. Paradoxically, foraging activity on it progressively increases when flowering decreases and a lessening amount of nectar and pollen is obtained. This unusually intense period of work shortens the life of many field bees, and is therefore responsible for an abnormal mortality rate.



Plate 41.

White Stringybark (Eucalyptus phaeotricha). Slacks Creek.

The characteristics of the honey, apart from colour, are not known definitely. Some beekeepers state that it has a slightly acrid flavour and poor density.

Tallowwood.

Botanical Name: *Eucalyptus microcorys* F. Muell.

Distinguishing Features.—A stringybark (Plates 42-44) with brown to orange bark, especially beneath the surface, leaves distinctly paler on the lower surface, flowers and capsules tapering into short stalks and very short lids to the buds.

Description.—A tree up to 230 ft. high but commonly less than 100 ft., with a dense green crown and brown to orange bark that can be pulled away in long strips; the trunk sometimes appears grey, but the bright colour is readily seen on stripping off a piece of bark. The leaves spread out from the twigs and taper to a sharp point; they are much paler on the under surface, mostly $2\frac{1}{2}$–5 in. long and mostly 3–5 times as long as wide. The flowers are carried in bunches at the ends of the twigs and in a few smaller ones among the leaves; they are $\frac{1}{2}$ in. wide and taper gradually into their stalks. The buds have a very short, rounded lid. The capsules also taper to their stalks but are somewhat cylindrical in the upper part; they are about $\frac{1}{4}$ in. long and slightly narrower, with the valves projecting very slightly or not at all.

Distribution.—Moreton and Wide Bay Districts, usually not very far from the coast in the higher rainfall country. Pure stands are not found but the trees may occur on the fringes of "scrub" (where the largest trees are found) or in mixed forest, where they are often scattered. It is known in northern coastal New South Wales to about as far south as Newcastle.



Plate 42.

Tallowwood (Eucalyptus microcorys). Left, branchlet with leaves, buds and flowers. Right, branchlet showing undersides of leaves.

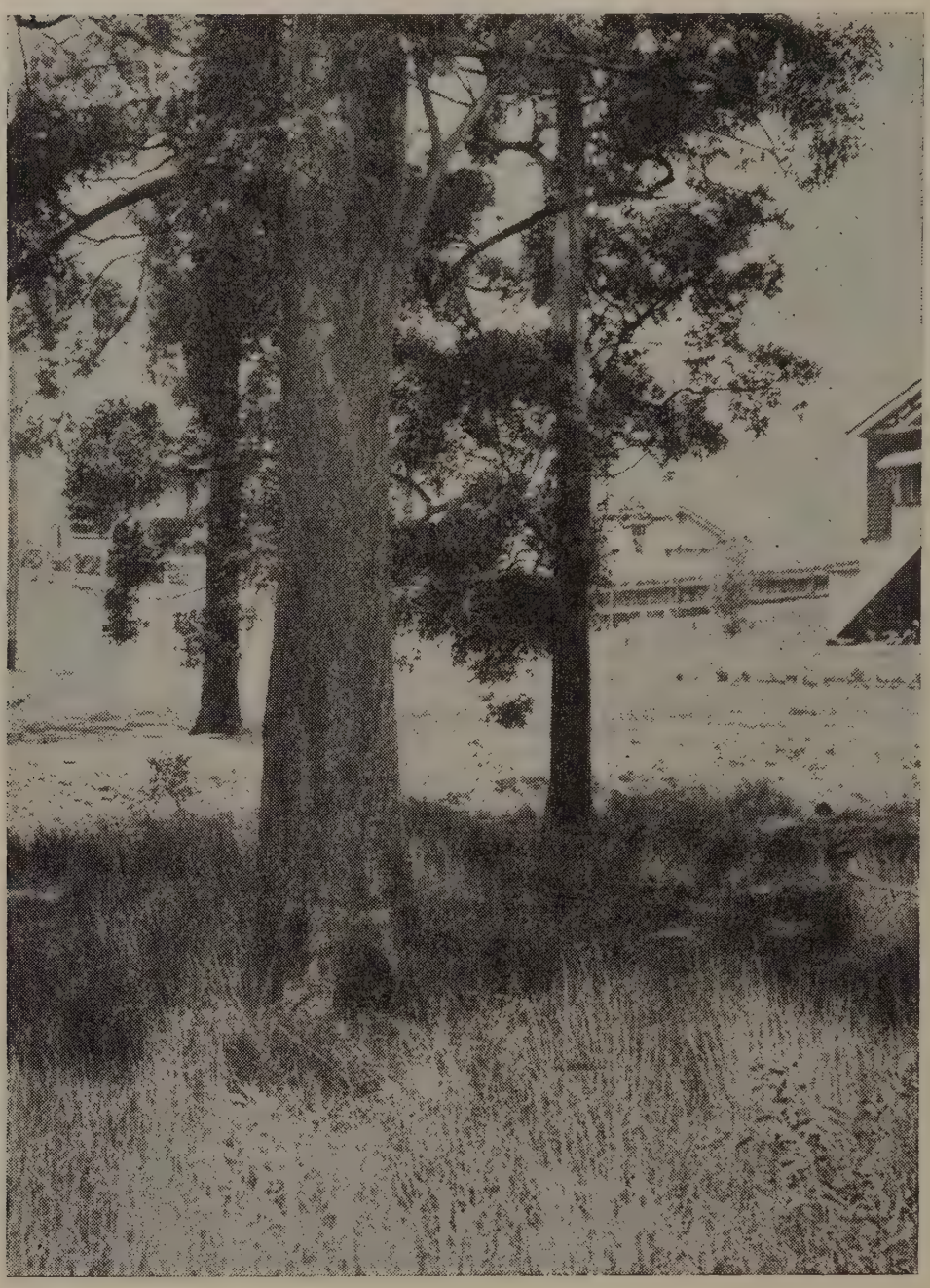


Plate 43.

Tallowwood (Eucalyptus microcorys). Portion of trunk.

Usual Flowering Time.—August to October.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

General Remarks.—This picturesque tree is of value to beekeepers in only a few localities. In the Caboolture, Woodford, Kilcoy and Pomona districts a fair quantity of pollen and a small amount of nectar are obtained from late winter to early summer. In these areas tallowwood is also useful for stimulating broodrearing.

Many beekeepers are surprised that this well-known species, which flowers regularly and heavily, is not of more importance in coastal areas. Apparently, the ornamental characteristics of the tree, which

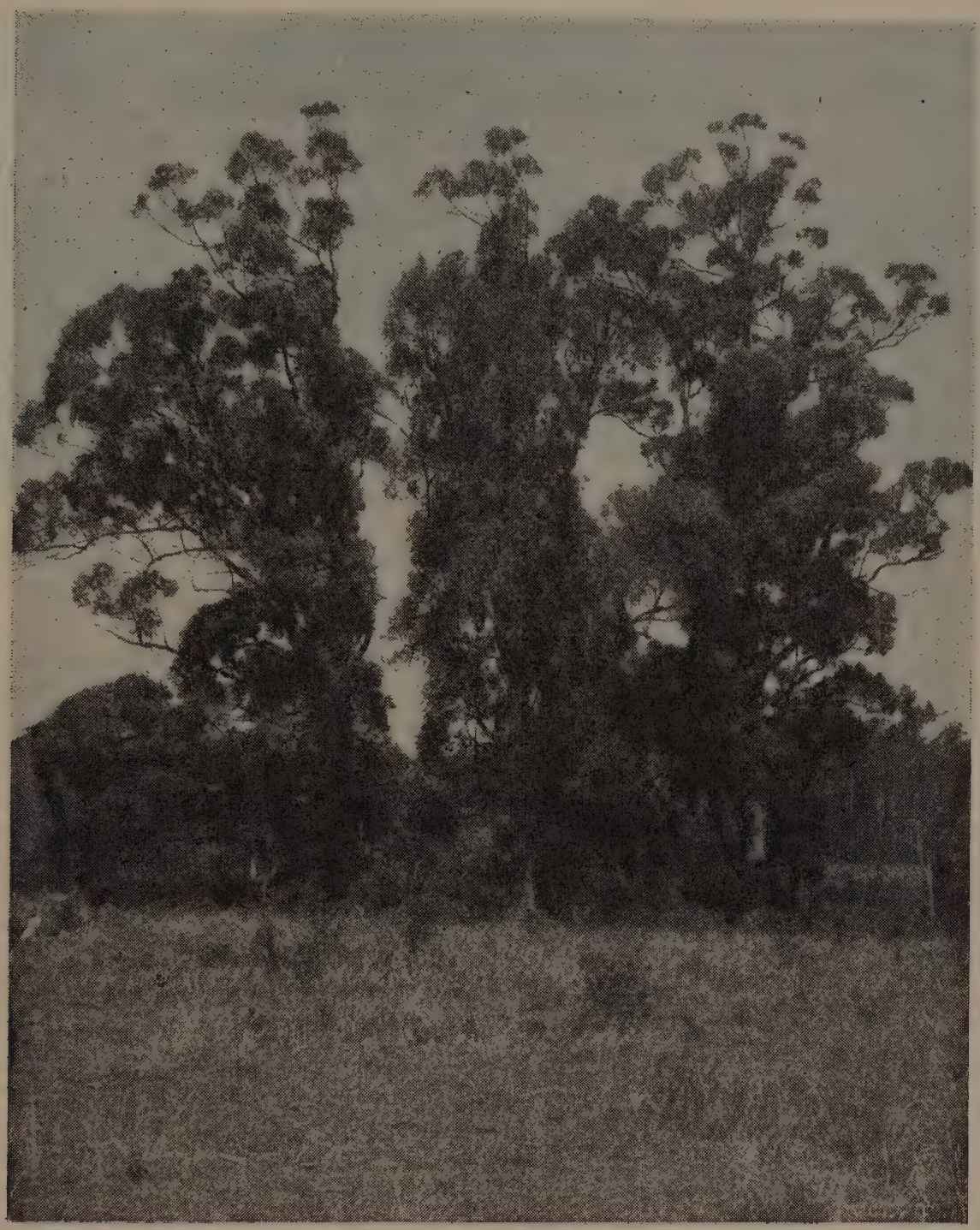


Plate 44.

Tallowwood (Eucalyptus microcorys). Daisy Hill.

make it particularly outstanding in the forest landscape, help to create a false impression of its abundance in many districts.

[TO BE CONTINUED].

ROCKHAMPTON ENTOMOLOGICAL FIELD STATION.

With an improvement of the staff position in the Science Branch of the Department, it has been possible to reopen the Entomological Field Station at Rockhampton.

The officer in charge is Mr. T. Passlow. The services of the Station are available to growers in connection with insect pest control in fruit and vegetables in the Rockhampton area and general insect troubles in the Central District.

Book Reviews.

Feeding Farm Animals in Australia.

By A. C. T. HEWITT, M.Agr.Sc.

The author of this book, as Livestock Science Officer in the Victorian Department of Agriculture, has been closely associated with the feeding and management of livestock for very many years. His practical knowledge of stock is evident throughout its pages.

Written primarily for stock-owners and students of agriculture and veterinary science, this book can be recommended as a reference work to those readers.

Before getting down in earnest to the subject of feeding the various classes of livestock, the author has written several chapters on the principles of feeding farm animals and the various foodstuffs available for use in Australia.

The chapter on pastures, shrubs and trees as stock foods contains well illustrated sections on haymaking and silage-making that are of particular interest.

Turning the pages at random, one finds interesting notes on such things as clearing stagnant water, teaching calves to drink, stock equivalents for expressing carrying capacity of pastures, feeding dogs and cats, and so on.

A worthy addition to Angus and Robertson's Australian Agricultural and Livestock Series, the book is available from booksellers for 45s.

Australian Plants for the Garden.

By THISTLE Y. HARRIS, B.Sc., M.Ed.

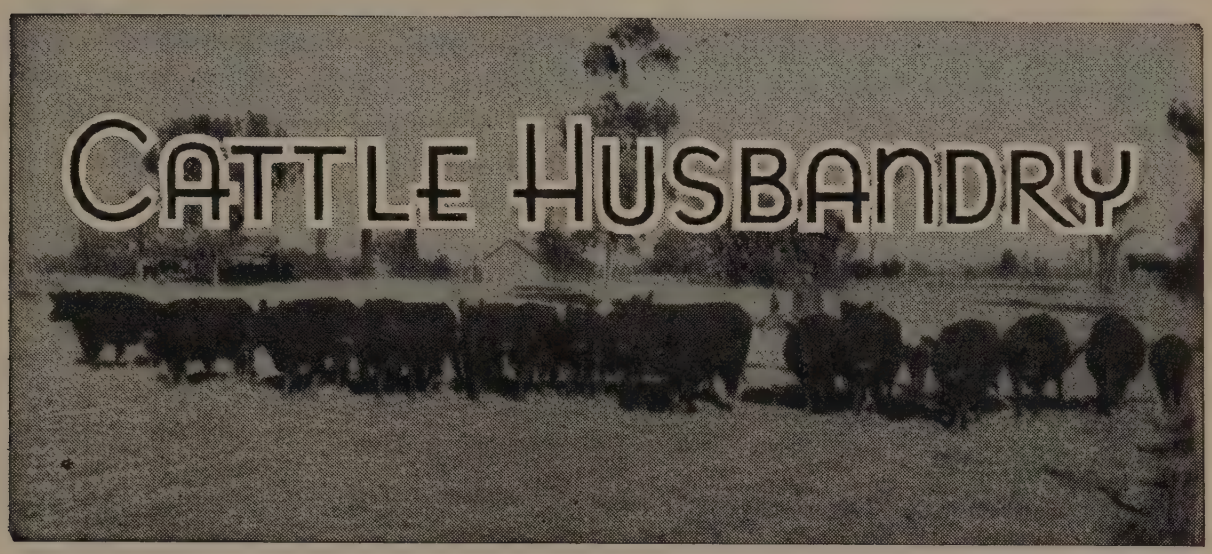
This profusely illustrated book of 350 pages, written by the author of *Wild Flowers of Australia,* presents several novel features. Australia is very rich in beautiful and unusual plants which are too often passed over in favour of the more publicised introduced trees, shrubs, flowering plants and ferns. This book is designed to awaken Australians to the beauty of their own flora. Hundreds of these decorative plants and the requirements for their growth are adequately described for the guidance of the home gardener.

A very useful section of the book is the inclusion of detailed plans of gardens composed solely of Australian plants. These plans are varied to meet the needs of gardens of different size, aspect and topography.

Early chapters deal with planning and preparation of gardens, garden craft, the propagation of plants by seed or cutting, pruning, and the control of diseases and pests. A chapter of interest to amateurs is that devoted to the naming of plants.

The book is well written by an author who obviously enjoyed her task. The foreword is by the late C. T. White, for many years Queensland Government Botanist and one of the leading botanists of the Southern Hemisphere.

Australian Plants for the Garden is published by Angus and Robertson, and is obtainable from all booksellers at 63s.



The Indian Breeds of Cattle and Their Crossbreeds.

G. I. ALEXANDER and K. F. HOWARD, Cattle Husbandry Branch.

THE cattle population of the world is widely spread and the various strains and breeds which have developed in the different areas have been peculiarly adapted to the particular conditions under which they have been bred.

The environment of the animal may be divided broadly into two main categories—vegetation and climate. The former is dependent on the latter and is adapted to the climatic conditions, as are the indigenous stock of the area. In areas where there is a rapid growth of coarse pasture and a long dry season or drought, the indigenous cattle have become adapted to such conditions. Where there is abundant growth of lush grasses throughout the year the stock have been more carefully selected by man to suit the environment. They are better able to utilise fodders of high nutritive value, but are badly adapted to less favourable environments.

Besides its effect on the vegetation, climate exerts a direct effect on the animal. In countries where there are severe winters, the cattle possess a seasonal growth of soft fine hair which helps them to withstand the cold. These cattle also lay down reserves of fat under the skin which insulates the beast against the cold.

Hot humid areas required the development of other adaptive mechanisms by the animal. Cattle from these regions possess the ability to sweat and their skin hangs in loose folds to provide a greater cooling surface. The pigment of the skin and hair is such as to promote reflection of the sun's rays and so limit the absorption of solar heat. Dark skin pigment combined with light hair colour is most efficient in preventing the absorption of the ultraviolet rays of the sun, which produce overheating. The hair is much sparser than that of the cattle of temperate regions and is not as fine.

Man upset this fine balance which nature had achieved when he commenced transplanting stock into environments to which they were not adapted. Cattle in the temperate region had been selectively developed for many decades into specialised types of either beef or

dairy cattle. The attempt was made to transplant them to other environments rather than develop the indigenous breeds. These cattle from the temperate regions proved remarkably adaptable and thrived under a great variety of conditions. However, in certain localities, usually with hot humid climates, they were found to deteriorate rapidly. In these areas the milk production dropped, as did the rate of growth and fattening. Sustained high temperatures appeared to be more detrimental than a relatively wide daily variation with hot days and cool nights.

In order to improve the adaptability of the British breeds, various crosses with the Indian breeds of cattle (*Bos indicus*) have been tried. These Indian breeds were indigenous to the tropics but were not as highly developed for beef or milk production as the temperate breeds (*Bos taurus*). The two scientific names indicate that the stock belong to two distinct families, so crosses between the two are actually hybrids (that is, crosses between different species) rather than crossbreds, which are crosses between breeds of the same species. While the Indian breeds of cattle are not as sharply differentiated as the British breeds, there are nevertheless distinct strains into which they can be classified.

THE INDIAN BREEDS OF CATTLE.

Many breeds of cattle exist in India, but often there is so little difference between breeds that the geographical areas of origin and shape of horns may be the only guiding factors in separating one breed from another.

Of the Indian breeds, those described here are considered to be the most highly developed and have been used widely as a basis for cross-breeding.

The two principal breeds of Zebu or Indian cattle used in America are referred to by Americans as Guzerat and Nellore. These names refer to portions of the geographical areas from which the animals were imported, but the names commonly used for these two breeds in India are Kankrej and Ongole respectively.

Beef Types.

Kankrej (Guzerat).

This is a fast, powerful breed of grey Indian cattle and has been exported to the United States in the greatest numbers. In India they are used principally as draft cattle. The milk production of the cows is very low. The chief characteristics of the breed are—

(*a*) Head carried high; forehead wide; the face with a flat or dished profile.

(*b*) Long drooping ears.

(*c*) Well developed hump.

(*d*) Heavy skin.

(*e*) Moderately heavy dewlap and rather pendulous sheath.

(*f*) A comparatively short tail with black switch.

Ongole (Nellore).

These are short-boned, white or light grey cattle much valued in India for heavy work, but not considered suitable for fast trotting. Considerable numbers have been exported to northern South America

and other tropical areas. Some animals have been introduced to the southern United States. They are of large size and are quite muscular. The Ongole has a dewlap and sheath of moderate size. The forehead is relatively flat, and the skull is coffin-shaped. The orbital arches are not prominent and the face is slightly convex in profile.

Krishna Valley.

This breed resembles the Ongole closely. In both breeds the usual tendency is for males to be some shade of grey over the neck, shoulders, hump and quarters, becoming darker with age, while females are of a lighter shade and eventually become white, or nearly so, with age. The bullocks are massive, powerful animals useful for slow draft and for heavy ploughing; the cows are fair milkers.

Hissar.

This breed was developed in order to obtain larger, stronger animals for draft purposes. Other breeds, however, have been preferred to the Hissar and this strain has lost much popularity in India.

They are lyre-horned, grey cattle with foreheads resembling the Kankrej and Tharparkar.

Tharparkar.

Found in the arid, semi-desert regions, these cattle are medium-sized and of compact build. The bullocks are good workers; the cows are only fair milk producers.

Dairy Types.

Gir.

Cattle of this dairy breed are quite ponderous and have a pendulous dewlap and sheath, prominent forehead and lateral (often curled) horns. Some animals are entirely red, but the colour is usually mottled and varies from yellowish red to almost black. Some strains are nearly white, with a few spots of colour. The ears are markedly long and pendulous, with a notch near the tip. The dewlap is only moderately developed, but the sheath is usually pendulous.

The bullocks are large and powerful. They are used for draft purposes, but are rather slow and lethargic.

Sahiwal.

Sometimes called the Montgomery breed, the Sahiwal is essentially a milk breed. It is native to the central and southern portion of the Punjab, but is now widely used throughout India and Pakistan. These cattle have recorded productions of over 10,000 lb. of milk in a 10 months' lactation.

Reddish dun is the common colour, with some white markings. The cattle are of powerful build, the bullocks being useful for slow draft work. The head is broad, with short stumpy horns, and the dewlap and sheath are heavy and pendulous.

Red Sindhi.

Originating from the country around Karachi, these cattle have gained wide popularity as dairy stock. They have apparently originated from small hill cattle. Their colour is red or fawn, frequently with some white on the face and dewlap (Plate 1). The sheath and dewlap are rather heavy and the udder is quite well developed. Many cows have been recorded as producing 4,000 lb. of milk in a 10 months' lactation.



Plate 1.

A Red Sindhi Bull of a Type being Bred with Jersey Cattle in the United States.

[This and some other photographs from Texas Journal of Science.

The Afrikander.

Belonging to the family *Bos indicus,* the Afrikander (Plate 2) is closely related to the Indian breeds and has been used for cross-breeding purposes. These hardy animals are reputed to be extremely resistant to drought and show a degree of resistance to ticks and other insects.

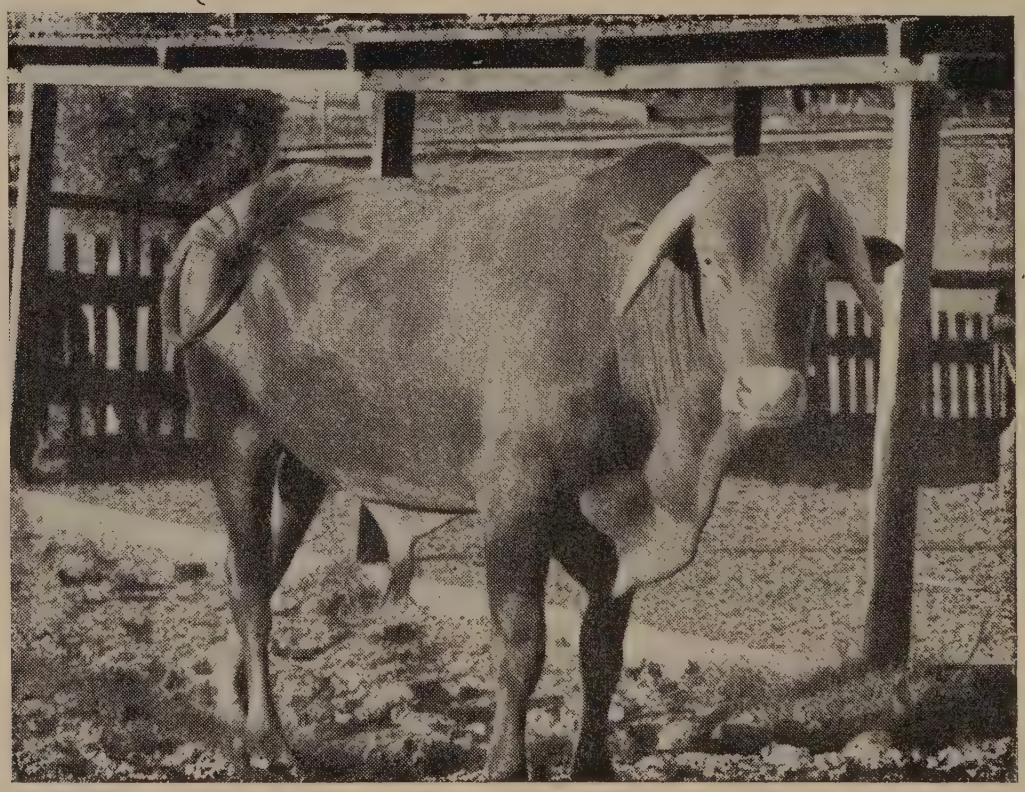


Plate 2.

An Afrikander Bull.

Afrikanders are big animals, but they are rather narrow of body, leggy and somewhat fine-boned, and lack some of the good qualities of the Indian strains of Kankrej and Ongole.

The American Brahman.

The popular name in America for the Zebu or Indian cattle is "Brahman". The first importations of Zebus to America were in 1849, but it was not until the early 1900's that appreciable numbers entered the country. Kankrej, Ongole, Krishna Valley, Gir and possibly others were introduced.

In the United States these breeds were not retained pure, but were crossed with purebred and grade cows of European origin. Further grading up with Indian breeds, plus selection for beef characteristics, led to the establishment of the American Brahman (Plate 3).

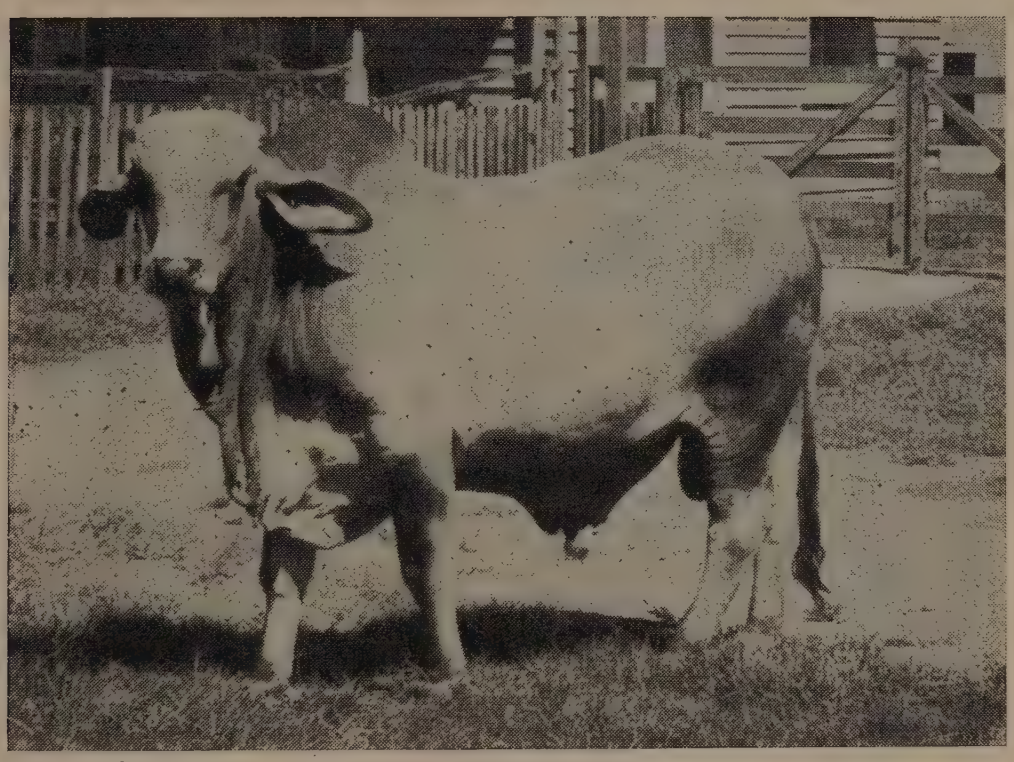


Plate 3.
An American Brahman Bull.

Selection within this relatively restricted number of cattle resulted in the standardisation of a type superior in beef qualities to the Indian breeds, but still retaining the distinctive characteristics of coat colour and ability to thrive under tropical climatic conditions.

To-day, Brahman blood is a feature of the cattle industry in the southern parts of the United States and in that region it is continuing to gain popularity. It has been claimed that . . . . "The Gulf Coast area of Texas and Louisiana has probably the densest cattle population of any similar geographical area in the world. The Brahman absolutely dominates this population and but for Brahman blood this area would support but a small part of this great beef industry."

Advantages.

The following advantages are claimed for Indian cattle:—

(*a*) Heat tolerance is the chief advantage attributed to Zebu cattle. This characteristic is dependent on a number of factors:—

(i) The large surface area of the hide of the Zebu is considered to assist in the elimination of heat.

(ii) Zebu cattle sweat freely and so are less inconvenienced by high temperature than are British breeds. This point has been the subject of controversy, as some people hold that British breeds have as many sweat glands as Zebu cattle.

(iii) Their light hair is responsible for greater reflection of the sun's rays than that of the British breeds.

(iv) The dark pigment of the skin prevents much penetration by the ultraviolet rays of the sun and so minimises their heating effect.

(v) The density of coat of Zebu cattle is much less than that of British cattle and so the coat absorbs less heat than the thicker coat of British cattle. The beast with a dense long coat is less likely to thrive in the tropical areas than the one with a sparse, short coat.

The above five factors make the Zebu a good grazier, eating at any time during the day or night. It does not have to rush its feed during the cooler periods of the day.

(*b*) They are capable of travelling long distances to water, as their walking pace is fast and they can jog along without being inconvenienced. This permits wider grazing by Zebus and, in times of feed shortage, enables them to maintain themselves in better condition than cattle of the British breeds.

(*c*) Their breeding span is longer than that of British breeds.

(*d*) Although they reach sexual maturity late, Zebu bulls are capable of serving more cows than bulls of other breeds.

(*e*) It is believed that Zebu cattle possess *some* degree of tick resistance, which may be associated with their short hair, dense skin and the secretion of sebum in their sweat, which seems to act as a repellent to insects. The muscular development under the skin enables the beast to twitch its hide and so dislodge insects in a manner impossible to British breeds.

Disadvantages.

Probably the Zebu's greatest disadvantage is its temperament. It is definitely a nervous, highly strung beast and different handling methods are called for from those used with British breeds. The Zebu and its crosses are, however, quite manageable when proper handling methods are employed.

Description.

The following is the standard of excellence as set out for American Brahman cattle by the American Brahman Breeders' Association.

(*a*) *General Appearance.*

	Score. Bull.	Cow.
1. *Colour.*—Solid or gradual blending of two colours. Unpigmented skin objectionable. Brindle is a disqualification. Muzzle and hoofs dark. A white nose, light coloured hoofs or white switch undesirable	1	1
2. *Size and Weight.*—Well developed according to age, bulls 1,600 lb. to 2,200 lb. at maturity in good flesh. Cows 1,000 lb. to 1,500 lb. at maturity in good flesh	8	8
3. *Form.*—Massive, broad, deep, medium low-set, moderately compact, symmetrical, smooth. Straight back with a slightly rounding rump. Any appreciable dropping off from hips to region of crops or hump undesirable. Bull should possess hump of ample size, located directly on top of shoulders, moderate in thickness, somewhat resembling a bean in shape and extending backwards. Females should show hump of moderate development, more oval in shape than that of bull and located on top of shoulders. Bottom line straight except for sheath in bull and navel in cow. Excessive development of sheath or navel objectionable. Flanks full. Bull should possess pronounced masculinity. Females should show all characteristics of refinement and feminity which would indicate a good producer. Walk straight, strong and active	8	8
4. *Quality.*—Hide soft and pliable, of medium thickness, densely covered with hair of medium texture, oily to the touch. Well developed dewlap with generous amount of soft pliable skin arranged in folds extending from lower jaw to chest floor. Moderate development of loose skin under belly. Bone ample in substance, clean cut and strong. Fleshing smooth	5	5
5. *Flesh Covering.*—Thick, firm, mellow and uniformly distributed.	7	6
	29	28

(*b*) *Head and Neck.*

1. *Head.*—Forehead broad, practically flat to moderately prominent, face short, slightly tapering toward nose; muzzle full, nostrils wide and open; lips dark. Eyes mild and full with good width between them. Distance from eyes to muzzle of moderate length. Ears ample in length, moderate in width, and characteristic of predominating strain. Horns wide apart at the base, thick, varying in length and shape according to predominating strain. Horns of cows should be thinner than horns of bulls	7	7
2. *Neck and Throat.*—Neck short with full crest in bull; neat in cows, blending smoothly into shoulders. Throat clean on sides, but with development of loose skin underneath	2	2
	9	9

(*c*) *Forequarters.*

1. *Shoulders.*—Moderately oblique, smooth and well covered on blades, broad on top and covered by hump	5	4
2. *Brisket.*—Not too prominent. Wide and moderately deep, covered with loose skin	1	1
3. *Legs.*—Moderately short, straight and squarely placed. The forearms should show heavy muscular development, bones strong and clean with dense joints	3	2
	9	7

	Score. Bull.	Cow.
(d) Body.		
1. *Chest.*—Wide and deep, round and full back of shoulders. Good width on chest floor and well filled in fore flank	6	6
2. *Ribs.*—Well sprung from backbone, arched, with ample length to give depth to body. Symmetrically joined to loin and crops, well covered with smooth, thick, natural flesh. There should be no appreciable depression behind the shoulders	7	7
3. *Back.*—Broad and level from hump to hooks; slightly rounding from hooks to pin bones or tail head. Well covered with thick smooth natural flesh. Hooks moderately wide and well laid in. A sharp angle of back between and extending above hooks objectionable	8	8
4. *Loin.*—Broad, thick, level, blending smoothly into back and rump	7	7
	28	28
(e) Hindquarters.		
1. *Rump.*—Long, wide, nearly level (slightly rounding toward tail head), smoothly joined to loin. Tail head smooth with tail coming neatly out of body on a line with or slightly below level of the back and hanging at right angles to it (steep slope objectionable)	8	8
2. *Hooks.*—Slightly below level of back, medium in width, well laid in and moderately covered with flesh	1	1
3. *Thighs and Twist.*—Broad, thick, full, and deep, extending well down to hocks. Twist deep and full	8	8
4. *Legs.*—Moderately short, straight, and squarely placed; perpendicular from rear view but slightly inclined forward below the hocks; muscular above hocks; bone with ample substance, clean and dense. Strong, short moderately sloping pasterns. Toes uniform and ample in size	2	2
5. *Tail.*—Neatly attached to the body on a level with the top line or slightly below, long, whiplike, with dark switch	1	1
6. *Udder.*—Ample in capacity, extending well forward in line with belly and well up behind; not fleshy. Teats moderate in size, squarely placed, well apart		4
7. *Scrotum.*—The scrotum should contain two testicles of equal size; only one testicle showing is very objectionable	1	
	21	24
(f) Disposition.		
Alert but docile (excessive nervousness highly undesirable) ..	4	4
Total	100	100

BRAHMAN CROSSES.

Beef Cattle.

Santa Gertrudis.

This breed is made up of approximately three-eighths Shorthorn and five-eighths Zebu. It is claimed not only to possess the advantages of both breeds, but also to have attained a high degree of uniformity. A breed society has been formed in America. The Santa Gertrudis is the only breed developed from a Zebu-British breed cross that is recognised by the United States Department of Agriculture.

A pamphlet on this breed and its possible application to Queensland conditions is available from the Queensland Department of Agriculture and Stock.

Beefmaster.

This breed (Plate 4) is made up of Zebu, Hereford and Shorthorn blood. Crossbreeding commenced on the Lasater Ranch in Texas in 1908, emphasis being placed on the development of a strain of cattle that would produce a choice, quick-maturing heavy calf at 8 months under range conditions. Progeny testing is being used to determine the superiority of bulls and all characters deemed non-essential have been disregarded. Great emphasis has been placed on fertility, weight, conformation, thriftiness and milk production. Colour is disregarded, but reds and dark browns are the predominating colours.

These cattle are bred under range conditions, so no exact pedigrees are kept, but the cattle are approximately one-half Zebu, one-quarter Hereford and one-quarter Shorthorn blood.

The original breeder claims that his Beefmasters will outweigh British breeds by 30 per cent. at any age without any supplementary foodstuffs.

The breed has shared with the Santa Gertrudis the honour of being the cattle gaining the most weight in tests carried out by the United States Department of Agriculture.



Plate 4.

A Beefmaster Yearling Bull.

Brangus.

This breed (Plate 5) was originated by the Paleface Ranch of San Antonio, Texas, as they preferred the Angus for crossing with Zebu on account of body conformation, distribution of flesh, amount of finish, dressing percentage and the ability to top off rapidly with the least food consumption.



Plate 5.
Half-bred Brahman x Angus Herd Bull.

Various proportions of Zebu blood have been tried in this cross. The present strain of three-eighths Zebu and five-eighths Angus is considered to be well fleshed, with the ability to convert feed efficiently to high quality beef. The rumen is smaller than in the British breeds but the cattle feed often, so they obtain ample feed. The small rumen is an advantage, giving a high dressing percentage.

Braford.

On large open-range pastures of the Gulf Coast region of U.S.A., Brafords, which are Zebu-Hereford crosses (Plates 6 and 7), have proved to be better adapted to the climatic conditions than Herefords. Several proportions of Zebu and Hereford blood have been tried. The weaning weights of calves resulting from the various crosses are listed as follows:—

(1) Hereford bull on half-Zebu cows .. .. 460 lb.

(2) Hereford bull on quarter-Zebu cows .. 450 lb.

(3) Zebu bull on pure Hereford cows .. .. 330 lb.

(4) Hereford bull on pure Hereford cows .. 345 lb.

(5) Half-Zebu x Hereford bull on purebred Hereford cows .. .. 345 lb.

These results indicate that the best results were obtained with calves mothered by Zebu cross cows.



Plate 6.
Crossbred Brahman x Hereford Steer.



Plate 7.
A Braford Bull.

Charbray.

The Charolais, a French breed well known in America for its rapid growth, has been crossed with the Zebu to produce a well-rounded, very long animal with exceptionally heavy forequarters and a very deep body (Plate 8). The heart girth is very great in the better types. While the calves are usually very small at birth, they grow rapidly and bulls have been known to weigh 3,000 lb. liveweight, which is exceptionally heavy.

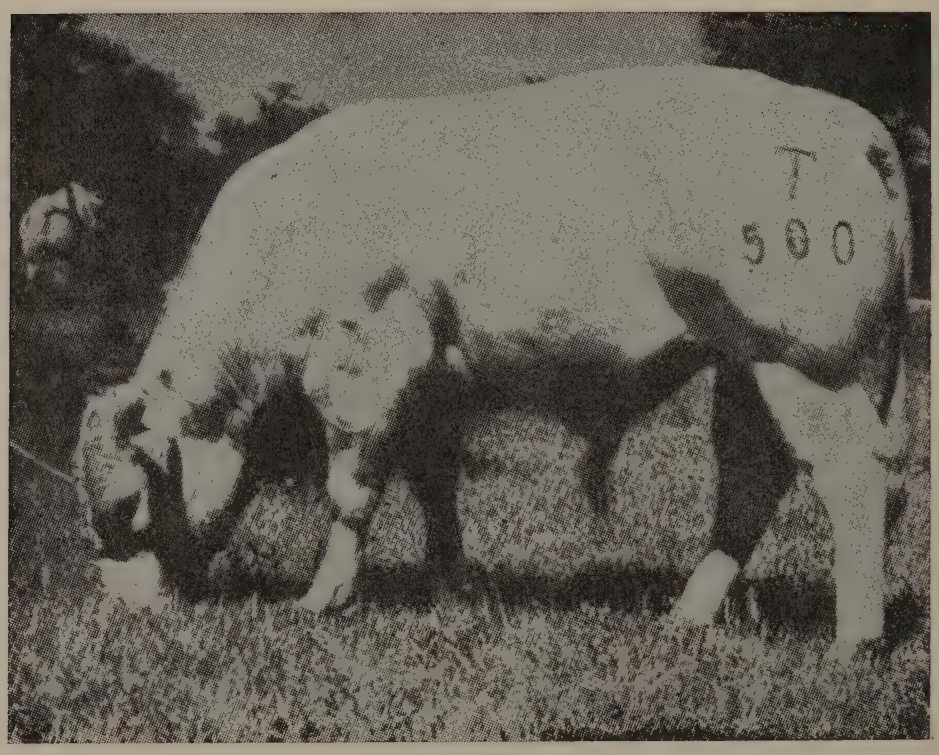


Plate 8.
A Charbray Bull.

Besides being used as a foundation for the Charbray in the United States, the Charolais has been used for crossbreeding in French Sudan and Morocco, Argentine and Brazil.

Brahorn.

This Brahman x Shorthorn cross has been largely overshadowed by the Santa Gertrudis, which originated from the Zebu and Shorthorn breeds.

Dairy Crosses.

The dairy breeds of Indian cattle have been intensively developed in India over recent years. Particular attention has been given to the Red Sindhi and Sahiwal, the latter tending towards a dual-purpose breed. The average annual milk production in India is about 600 lb. milk per cow, but Red Sindhi and particularly Sahiwal cows have produced far in excess of this figure with the assistance of good feeding and management.

The butterfat percentage of Brahman milk is above the average of the British breeds, being comparable with that of the Jersey and Guernsey breeds.

In India much crossing with Friesians has been carried out. The pure Friesian does not stand up to the severe summers, becoming thin, very distressed in hot weather and giving a greatly decreased milk production. The infusion of even a small proportion of Indian blood produces quite a considerable improvement in the milk production. Average production figures under conditions on the better-managed farms where the crossbreeding is being carried out, for animals with varying amounts of Friesian blood, are:—

Breeding of Cows.	No. of Records.	Average Amount of Milk.
$\frac{1}{8}$ Friesian	21	4,839 lb.
$\frac{1}{4}$ Friesian	175	5,982 lb.
$\frac{1}{2}$ Friesian	589	6,977 lb.
$\frac{5}{8}$ Friesian	204	6,985 lb.
$\frac{3}{4}$ Friesian	396	6,664 lb.
$\frac{7}{8}$ Friesian	86	6,180 lb.

In the United States, the Red Sindhi has been chosen by the Bureau of Dairy Industry for experimentation in the development of a breed of dairy cattle suitable for the hot humid areas. Two bulls were imported in 1946 and preliminary results indicate that Indian cattle can be used to introduce heat tolerance into domestic dairy breeds (Plate 9), a trait already inherent to some degree in the Jersey.

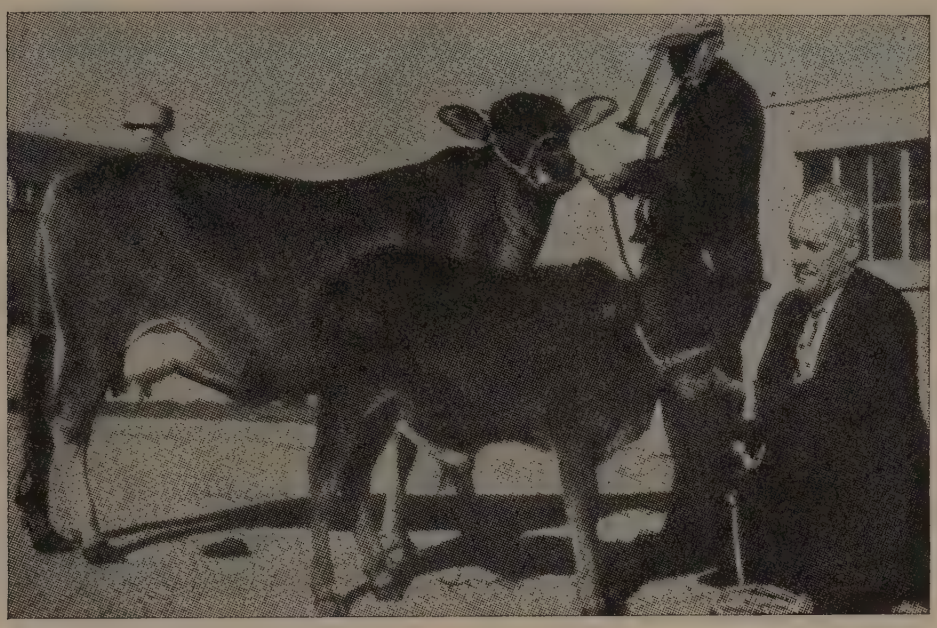


Plate 9.

Red Sindhi x Jersey Crossbreds. The cow is one-half Red Sindhi and one-half Jersey. The bull calf is three-quarters Red Sindhi and one quarter Jersey.

The Jamaican Department of Agriculture has developed a tropical dairy breed—the Jamaica Hope. This breed was developed over the period 1930-1950 by the infusion of Sahiwal blood into Jersey cattle. Originally Friesian and Guernsey cattle were also tried, but they proved less suitable than the Jersey for crossing and so were discarded.

It was found that animals with Zebu blood had a greater birth-weight and grew more rapidly than the pure Jerseys, the rate of growth increasing with an increase in the amount of Zebu blood. The difference in growth rate was more marked after the age of two years.

The milk production for a lactation increased with the amount of Zebu blood up to half, when it began to decrease. Animals with one-half Zebu blood appeared to be most suitable for milk production for Jamaican conditions.

The age at which heifers calved tended to increase with the amount of Zebu blood, and the length of the dry period increased also with an increase in the amount of Zebu blood.

CROSSBREEDING POLICIES.

The development of all these Zebu crosses has been the result of careful selection and, in many cases, progeny testing with a constant regard for the type being aimed at. The standardisation of the ideal type should be the aim of every cattle breeder. The crossing of two breeds, or more particularly species, introduces the possibility of obtaining a superior type, but the difficulty arises with the fixing of this improved type in succeeding generations.

Success or failure of any breed or cross in a particular locality will be governed to an extent by the presence or absence of an intelligently planned breeding programme. In an endeavour to obtain the advantages of the Zebu, breeding policies have varied from rigidly controlled programmes to that of indiscriminate use of Brahman blood with no apparent regard for type or uniformity.

Much can be learned from overseas experience. The following recommendations incorporate the basic principles followed by most overseas breeders in developing their new breeds.

There are three main methods of utilising Zebu blood, namely:—

(1) Crossing crossbreds.

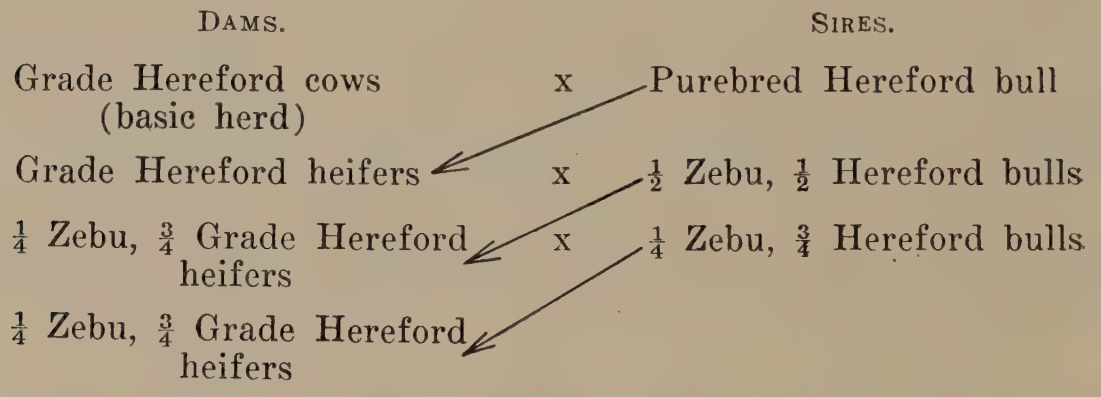
(2) Grading up to a standardised breed.

(3) A combination of (1) and (2).

Crossing Crossbreds.

Assuming that the foundation herd is predominantly one British breed, it should be as uniform as possible. If this is not the case, the herd should be graded up by the use of purebred bulls of the British breed predominating in the herd. One generation may be sufficient to allow selection of a line of heifers sufficiently uniform in type to act as the foundation herd for the crossbreeding programme. These heifers are then mated to bulls whose ancestry is half-Zebu and half that of the British breed in the herd.

This breeding technique may be illustrated thus:—



This policy calls for adequate subdivision so that the mating programme is not upset by mixed breeding. After a few years, there will be sufficient females with ¼ Zebu to form the entire breeding herd, so that the use of the ½ Zebu, ½ Hereford males may be dispensed with.

The ideal percentage of Zebu blood will vary according to the hardiness of the cattle already existing in the area as well as climate and other environmental factors. It is probable that the desirable amount of Zebu blood for the coastal country north of Rockhampton should be from three-eighths to one-half but much careful work will have to be done before this is decided.

As a general rule, the desirable proportions of Zebu blood would lie in the range between one-quarter and one-half, as cattle outside this range usually exhibit too few of the desirable features of both breeds.

To obtain stock having approximately half Zebu blood, the same procedure as before is carried out as far as the third mating. At this stage, the $\frac{1}{2}$ Zebu, $\frac{1}{2}$ Hereford bulls are used on the $\frac{1}{4}$ Zebu, $\frac{3}{4}$ Hereford heifers to produce $\frac{3}{8}$ Zebu, $\frac{5}{8}$ Hereford. By mating these back continually to $\frac{1}{2}$ Zebu, $\frac{1}{2}$ Hereford bulls, a near half Zebu-half Hereford herd can be built up.

To produce $\frac{3}{8}$ Zebu cattle, the $\frac{3}{8}$ Zebu, $\frac{5}{8}$ Hereford cows are produced as before and this percentage is maintained by the continued use of $\frac{3}{8}$ Zebu, $\frac{5}{8}$ Hereford bulls.

It must be emphasised that the overseas experimental work has shown that the Zebu blood is essential in the female side. Indeed, it may be preferable to have the female section of the herd possessing too high a percentage of Zebu blood for a desirable carcase, and use bulls with a higher proportion of British blood than would otherwise be the case. For example, pure Hereford bulls mated to $\frac{1}{2}$ Zebu, $\frac{1}{2}$ Hereford cows will produce progeny of $\frac{1}{4}$ Zebu, $\frac{3}{4}$ Hereford blood, which gives a more desirable carcase.

In all breeding programmes, the breed other than Zebu should not be changed—that is, Hereford x Zebu cross bulls to Hereford x Zebu cows, or Shorthorn x Zebu bulls to Shorthorn x Zebu cows.

Purebred Zebu bulls could be used to produce crossbreeds, but price and availability of purebred Zebu bulls put a strict limitation on their use outside stud herds.



Plate 10.

Brahman Cross Cattle in Saleyards in California. These cattle are commonly seen in the Los Angeles stockyards, indicating that they are not confined to the eastern part of the United States.

The greatest disadvantage of crossbreeding is that the large degree of variation requires a high degree of culling until the desired uniformity is obtained. There is also need for strict supervision.

Grading-up to a Standardised Breed.

This simpler process requires the continued use of purebred bulls of the desired breed. Bulls of a fixed Zebu breed, however, are dearer than crossbred bulls. The principal Zebu x British breeds which would be suitable for grading-up purposes are the Santa Gertrudis, Beefmaster and Brangus.

When grading-up to these breeds, quickest results may be obtained by using ½ Zebu cows as the foundation herd. The other half of the cows' breeding should be the same as that in the basic breed of that to which they are being mated—that is, for Santa Gertrudis, ½ Zebu, ½ Shorthorn cows would be used; for Brangus, ½ Zebu, ½ Angus cows are used. Beefmaster bulls may be mated to Shorthorn x Brahman or Hereford x Brahman cows.

Combined Crossing and Grading-up.

An example of this would be the following breeding programme:—

Dams.		Sires.
Grade Shorthorn cows	x	Purebred Shorthorn bulls.
Shorthorn heifers	x	½ Zebu, ½ Shorthorn bulls.
¼ Zebu, ¾ Shorthorn heifers	x	½ Zebu, ½ Shorthorn bulls.
⅜ Zebu, ⅝ Shorthorn heifers	x	Santa Gertrudis bulls.

POINTS TO CONSIDER WHEN CROSSBREEDING.

When breeding crossbred Zebus for beef, it is imperative to retain those characteristics which make the breed useful under tropical and arid conditions.

The type bred should combine the following points:—

(*a*) Loose skin, indicated by looseness of the skin under the neck and belly; (*b*) short sleek hair; (*c*) pigmented skin; (*d*) ability to produce sufficient milk; (*e*) good length and depth of body; square rump; broad flat back; flank and twist full and deep; (*f*) quiet disposition.

The chief points which should warrant culling would be:—

(*a*) Extreme ranginess, with light hindquarters, narrowness of body and general lack of depth and breadth; (*b*) extreme shortness in leg and body; (*c*) wild disposition; (*d*) sloping rump; (*e*) woolly coat.

Uneven colouring should not be given much attention in commercial herds, though colour may be a consideration when paddock sales are made.

HANDLING ZEBUS AND THEIR CROSSES.

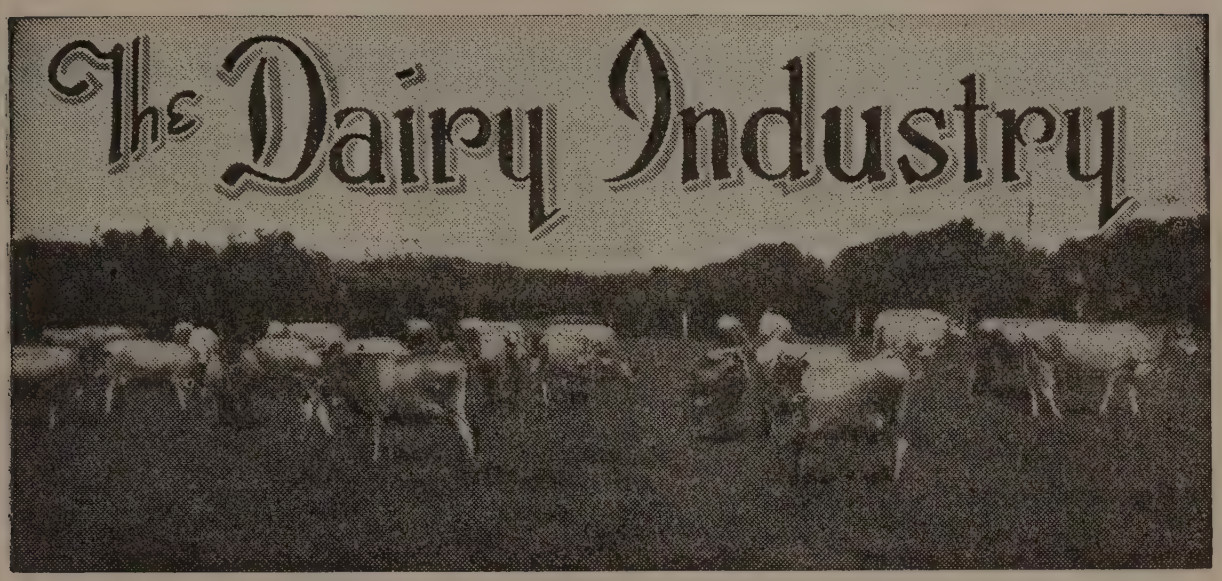
Stockmen who are used to handling Zebus assert that these cattle should be handled differently from British breeds. If handled well, however, Zebus may be less trouble than British breeds.

The main points in handling Zebus and their crosses are:—

(1) Handle steadily at all times.

(2) Avoid crowding and never attempt to hurry the cattle.

(3) Lead the cattle rather than drive them. (4) Avoid shouting.



The Manufacture of Cheddar Cheese in Queensland.

E. B. RICE and T. A. MORRIS, Division of Dairying.

AS was the case in most other countries, the cheesemaking industry in Queensland grew from the efforts of individual farmers to make more cheese than was required for their own needs. This surplus was sold in neighbouring townships to those people who were not able to make their own cheese.

Towards the end of the year 1888, a Government-sponsored travelling dairy began visiting farming centres to demonstrate factory methods of manufacturing butter and cheese. In the following year, a second travelling dairy came into being, and the adaptability of cheese manufacture to factory practice became more widely recognised. Until about 1892, all the cheese produced was made on farms. This production was 170,000 lb. in 1890 and 141,000 lb. in 1891. It rose to 460,000 lb. in 1892 with the advent of factory-produced cheese. In 1893 the first cheese factory of any pretension was erected at Yangan, in the Warwick district.

With the growth of the factory system of manufacture, cheese production increased, and the number of cheese producers decreased from 234 in 1898 to 115 in 1900 and only 62 in 1902. The accompanying graph (Plate 1) illustrates the changes in the quantity of cheese produced, the number of cheese-producing units, and the total quantity of milk produced which have taken place since the early years of the cheesemaking industry.

It will be seen that the quantity of cheese produced has always been more closely connected with the total milk production, which varies according to seasonal conditions, than with the number of cheese-producing units. The latter rose during the expansion of the industry from 1908 onwards, but fell later because of the tendency to centralise manufacture at larger establishments and eliminate the smaller factories. Cheese production reached a peak during the 1939-1945 war years and since has fallen towards the pre-war level of about 14,000,000 lb. per year.

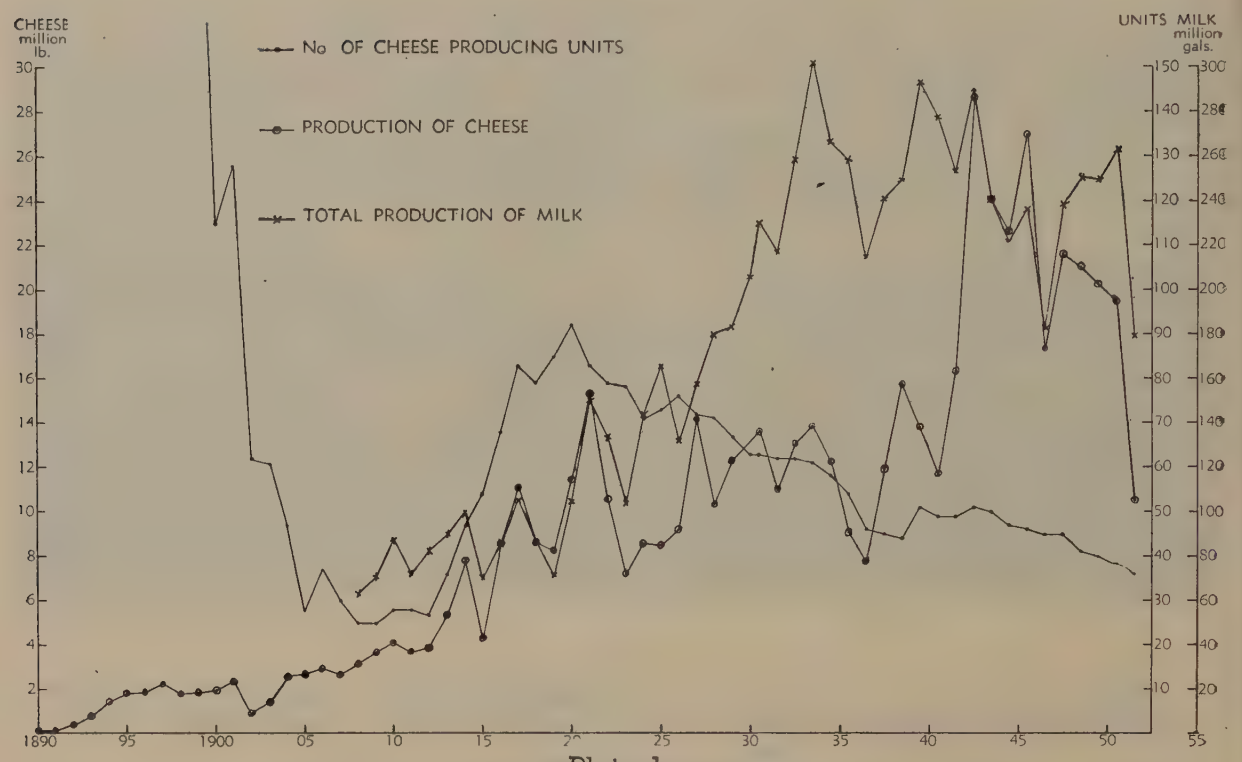


Plate 1.

Graph Illustrating the Development of the Cheese Industry in Queensland.

Since 1939, home consumption of cheese has taken a larger portion of production than in the preceding years. Whereas in the 20's and 30's approximately half of the cheese produced was exported, in more recent years the proportion exported has been closer to one-quarter of production. Great Britain has received the bulk of Queensland's exported cheese, but markets in the near north are also supplied.

The majority of the 36 cheese factories at present operating in Queensland are situated on the Darling Downs. The few others are located in the Burnett and Port Curtis districts. Closer settlement and more intensive farming reduce the area from which milk has to be drawn and these factors make the Darling Downs more suitable for cheese factories than most other areas. The cooler climate, favouring a better quality of milk and reasonable supplies of stock food throughout the whole year, are additional advantageous factors. The Atherton Tableland is another area which should be favourable for cheese factories, but at present there is none operating there.

The irregularity of the seasons in Queensland dairying areas is disadvantageous to seasonal dairying, which is practised in some other countries. Thus some cheese is made throughout the whole of the year. This, of course, ensures a more even supply of cheese but does not allow factories to cease operations for a time in order to carry out necessary maintenance work.

Mixed night's and morning's milk is used in manufacture and is delivered by individual suppliers or by motor transport services. The bulk of the manufacture is of the cheddar variety, which is being made from pasteurised milk in all but a few small factories. In addition, small amounts of Gruyere, Roman, Malling Red, Cottage and modified cheddar, such as Red Coon, are sometimes made. A non-fat-leaking cheddar cheese has been successfully manufactured by using homogenised cream and skim-milk. A considerable quantity of cheddar cheese is used in the production of processed cheese and cheese spreads.

The centralisation of cheese factories which is at present taking place is being accompanied to some extent by a much-needed modernisation of factories and equipment. In some cases, hand-operated cheese presses have been replaced by an hydraulic type which reduces the labour involved in pressing the cheese. Interest is being shown in mechanical curd-stirrers and temperature and humidity controls for cheese-curing rooms. These controls, which are very desirable under Queensland's summer conditions, have already been installed in a few cheese-curing rooms.



Plate 2.

A Modern Cheese Factory. A milk transport, with side-covers removed, is shown.

There is a growing realisation of the need for better facilities in many factories for the propagation and maintenance of cheese starters. The separation of whey is being carried out by several of the larger factories and the practice is becoming more widespread, due to an increasing appreciation of its economic soundness. The waxing of cheese can also be expected to become more generally adopted by factories in the future. Properly applied, suitable waxes will reduce shrinkage losses and give cheese of better appearance.

A development which has become apparent in recent times is the tendency to use cheese manufacture as a means of balancing supply and demand in connection with the liquid milk trade. Because cheesemaking allows the handling of variable quantities of milk, involves comparatively small overhead costs, and offers a good financial return, it is a very advantageous means of dealing with surplus milk.

Some Facts Concerning Cheese.

Legal Standards.

The Dairy Produce Acts of Queensland define cheese as follows:—

"Cheese shall be the solid or semi-solid food product obtained by coagulating the caseinogen of milk, cream, or skim milk by means of approved rennet, pepsin, or acids, with or without the addition of

ripening ferments or approved seasoning ingredients. It shall not contain any foreign fat or other foreign substance except approved quantities of harmless vegetable colouring matter."

The Acts also state that wholemilk cheese shall contain not more than 40% water and not less than 50% fat in the dry matter. A cheese containing 40% water would therefore have to contain at least 30% fat.

A normal average Queensland cheddar cheese might have the following composition when immature:—

Moisture	37.0%
Fat	33.5%
Protein	24.5%

Mineral matter 5.0% (salt 1.6%, other mineral matter 3.4%).

Cheese as a Food.

The main food constituents of cheese are butterfat and protein. Because of its high proportion of a very good type of protein, cheese is regarded as an excellent protein food. It forms a cheap but very satisfactory substitute for meat. One pound of cheese has practically twice the food value of one pound of meat and carries much less waste. There is a great demand for cheese in time of war, because, besides being a very sustaining and health-giving food, it is more easily transported and stored than meat.

In addition to containing a well-balanced proportion of protein to fat, cheese contains vitamins A, D and E, which are essential for the maintenance of normal health and vigour, disease resistance and reproductive ability. The minerals calcium and phosphorus, which are so important in the formation of teeth and bone in the human body, are also present. Cheese is a relatively concentrated, and, contrary to popular opinion, an easily digested food, with an appeal to a wide range of tastes. In either the raw or the cooked state it can be made up into a great variety of appetising and nourishing dishes. There is a need, from a nutritional viewpoint, for a greater consumption of cheese in Australia. This country lags well behind many other countries in its consumption of cheese per person. Europeans, particularly, eat much more cheese than Australians. It is possible that as a result of the influx of a large number of immigrants from Europe, Australians may become more educated in the ways of using cheese in the diet.

[TO BE CONTINUED].

NORTHERN DAIRY LABORATORY.

Dairy farmers in the far north are invited to visit the new dairy research laboratory recently opened by the Department of Agriculture and Stock on the premises of the Atherton Tableland Co-operative Butter Association at Malanda.

The Officer in Charge (Mr. C. C. Garrick) will be pleased to conduct visitors over the laboratory and explain to them the scope of its activities in their interests.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 13th AUGUST, 1953.)

Breed.	Owner's Name and Address.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H.M. State Farm, " Palen " Stud, Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
	L. Puschmann, " Tayfeld " Stud, Taylor
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road Greenslopes
	W. F. Ruhle, " Felbar " Stud, Kalbar
	C. E. Edwards, " Spring Valley " Stud, Kingaroy
	G. J. MacLennan, " Murcott " Stud, Willowvale
	H. M. Wyatte, " Cumberland " Stud, Rocky Creek Yarraman
	C. F. W. & B. A. Shellback, " Redvilla " Stud, Kingaroy
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	H. R. Gibson, " Thistleton " Stud, Maleny

TESTED HERDS—continued.

Breed.	Owner's Name and Address.
Large White	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	R. S. Powell, " Kybong" Stud, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, "Lauraven" Stud, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
	N. E. Meyers, Halpine Plantation, Kallangur
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Crop Rotations for Soil Conservation in the Lockyer Valley.

E. C. DARLEY (formerly Assistant Agronomist, Agriculture Branch).

THE Lockyer Valley and the catchment area surrounding it occupy an area of about 1,140 square miles in south-eastern Queensland. The principal towns—Gatton, Laidley and Helidon—are situated on the rich alluvial soils formed by the various creeks within the region. Rolling hills and steeper country are characteristic of the non-alluvial land.

The area has warm to hot summers, and a number of frosts occur during the winter months. The rainfall is mainly of summer incidence and is sufficient to support mixed farming and dairying. Supplementary irrigation enables a system of intensive cropping to be followed on the alluvial soils.

The soils of the Lockyer Valley can be divided into two main categories:—

(1) Non-irrigated soils of the slopes which are mostly used for dairying and its attendant crops. These soils may be divided further into two main groups depending upon their climax vegetation:—

(*a*) The scrub soils, more fertile and often used for cultivation in conjunction with dairying.

(*b*) The forest soils which are poor in fertility and are not often used for cultivation. These soils find their main use in providing herbage for grazing.

(2) Irrigable soils comprising the dark brown to black fertile clay loams of the flood plains along the various creeks.

EROSION IN THE LOCKYER VALLEY.

Soil erosion in the Lockyer Valley is on the increase.

Sheet erosion is of prime importance and is found on the cultivated, non-irrigated soils of the slopes. Cases of severe damage due to sheet erosion are very evident in the Prenzlau, Hatton Vale, Plainland,

Blenheim, Ropely and Woodlands areas. This type of erosion is most severe on the cultivated paddocks, but does occur to a slight degree on the lands carrying the poorer pastures. Such pastures do not supply sufficient cover to fully protect the soil, especially after droughts and burning.

Gully erosion is not widespread, but is evident in cultivated areas, more particularly in the Blenheim and Ropely areas, and along roadsides.

Tunnel erosion occurs in isolated areas, for example in the Helidon area.

Riverbank erosion affects the alluvial land and is perhaps more severe in the sandy creek banks of Lockyer Creek near Gatton. This type of erosion has also proved expensive in the maintenance of the O'Reilly Weir on Lockyer Creek.

During 1950, landslips appeared on treeless well-pastured scrub soils at Mulgowie and Mt. Berryman, but such phenomena are perhaps outside the scope of ordinary soil conservation measures.

RAINFALL OF THE AREA.

The average annual rainfall for the area is approximately 29 inches and is mainly of summer incidence (Table 1).

TABLE 1.

Average Rainfall for Two Centres in the Lockyer Valley Based on 30-year Records.

Month.	Gatton.	Laidley.
	Points.	Points.
January	481	428
February	350	364
March	291	280
April	201	199
May	137	119
June	186	190
July	137	131
August	83	78
September	138	136
October	185	184
November	301	295
December	403	409
Annual Average	2,893	2,813

The character of this rainfall distribution is of importance in determining what rotation of crops will afford the soil the greatest protection during the months of heavy rains. Heavy summer storms and unusually heavy monsoonal falls during January, February and March constitute the main erosion hazards.

NON-IRRIGATED SOILS OF THE SLOPES.

Scrub soils are usually reddish brown in colour, with marginal soils being of a lighter hue. In texture they are loamy, and often include open sandy loams. Their depth is usually not very great, the surface soil often being no more than six inches in depth and sometimes less. Originally they were fairly fertile, being well supplied

with potash and phosphate but often lacking adequate nitrogen and organic matter. They are freely drained, and do not possess a high water-holding capacity. Areas where these soils occur are primarily used for dairying and for the production of such crops as suit the requirements of the dairy farmer. Observations suggest that nitrogenous fertilizers would be useful for non-leguminous crops.



Plate 1.

Irrigating Lucerne in the Lockyer Valley.

The cultivated forest soils are sandy loam types, light in colour, low in organic matter and fairly well supplied with phosphate and potash, although they are uniformly low in nitrogen; hence nitrogenous fertilizers will give good growth responses. Their physical structure is poor and water-holding capacity low. They are freely drained for the most part and have a clayey layer at a depth of about 9–12 in.

Certain areas of these non-irrigated soils show very obvious signs of over-cultivation. It is known that many of the paddocks have been cultivated continuously for the past 50–60 years. Apparently there has been a general reluctance to adopt proper rotation principles and turn cultivated areas back to pasture and use land out of pasture for cultivated crops.

Crops Grown and Rotations Practised at Present.

In order of importance the crops grown on these hillside soils are:—

Maize and fodder sorghums for grain and cow-feed; pumpkins for market; Sudan grass for grazing; oats for grazing; sweet potatoes for market and pigs; cowpeas for grazing and green manure; white panicum for grazing and hay; Japanese millet for grazing and hay; lucerne for grazing and hay; cotton; and broom millet.

In practice, crop rotations may be interrupted by weather conditions, labour and machinery difficulties, economic considerations, and so on. However, two examples of typical crop rotations, covering three to four years, which have been followed on these soils for some years are shown hereunder.

1.	Pumpkins	August-November.
	Sorghum	January-June.
	Sweet potatoes	August-November.
	Oats	March-August.
	Cowpeas	October-February.
	Fallow	February-September.
	Sudan grass, white panicum or Japanese millet	September-April.
2.	Maize	August-April.
	Fallow	April-August.
	Pumpkins	August-December.
	Oats	March-August.
	Sudan grass	October-April.
	Fallow	April-August.
	Cowpeas	September-December.
	Sorghum	February-June.



Plate 2.

Irrigated Potato Crop, with Lucerne Field in the Background, Gatton District.

For successful cropping with these rotation systems under dry-farming methods, land preparation and cultivation must be thorough to keep weeds in check, to trap rainfall (thus building up subsoil moisture), and to create conditions for maximum soil nitrate development. These requirements can be met only by frequent working of the land to destroy weed growth and conserve moisture, which is so necessary in view of

the limited seasonal rainfall. Thus the soil is frequently reduced to a fine state which is susceptible to severe erosion by summer storms and the heavy seasonal rains of the January to March period.

The rotations are not satisfactory because the soil is more or less exposed continuously to erosive influences and inadequate provision is made for the regular addition of organic matter to the soil, while the absence of a pasture phase in the rotation to restore soil structure is a serious omission.

The main crops planted and grown during the November to March period, which is the critical time for soil losses due to water erosion, are fodder sorghums, maize, Sudan grass and cowpeas. Sorghum and maize do not provide much protection for the soil, as they are row-cultivated and require clean cultivation for the best results. Cowpeas and Sudan grass are much more satisfactory in protecting the soil and preventing the movement of soil particles. The worst erosion hazards are the bare areas of land which are present during the latter end of this period prior to the planting of oats in March.

Crops such as pumpkins, sweet potatoes, Sudan grass and cowpeas, once established, give a good cover of vegetation to protect soil against the spring and early summer storm rains.

The infiltration capacity of the soil has decreased as a result of these rotations, since cultivation is fairly continuous. This is largely influenced by the loss of organic matter from the soil and the deterioration in soil structure. The rotations are not designed to return much organic matter to the soil. Although a certain amount is supplied by the pumpkins, sweet potatoes, cowpeas, maize and Sudan grass, the overall effect appears to be negligible.

The main fault of the rotations is the lack of a period devoted entirely to pasture. This period under pasture would need to be, for practical reasons, for as long as five years or even more. The prime benefit of this pasture would be in affording the soil good vegetative cover while improving the soil structure.

Suggested Rotations.

The rotations at present being used are not efficient from the point of view of soil maintenance and improvement. In this respect the following type of rotation is suggested as being more satisfactory:—

Pasture	5 or more years.
Fallow	June-August.
Sweet potatoes	August-November-December.
Oats	Early March-August.
Cowpeas	October-March.
Fallow	March-August.
Sudan grass	September-April.

This rotation allows the cash crop sweet potatoes to take advantage of the improved soil structure due to the pasture, and both summer and winter crops for the dairy cows are provided for. Unfortunately, it is not possible to avoid bare soil over the summer months of heavy rainfall, when land is prepared for oats, but by the inclusion of a pasture phase it does mean that soil in such a highly erodible condition is not exposed more often than once in every seven years or so.

The above rotation omits very useful crops such as maize, sorghums and pumpkins, and the following rotation is suggested as one in which these crops could be incorporated:—

Pasture	5 or more years.
Maize	August-June.
Pumpkins	August-November.
Cowpeas	January-April.
Fallow	April-August.
Sweet potatoes	August-December.
Foder sorghum	January-July.

This rotation allows ample scope for cash crops (maize, pumpkins and sweet potatoes). It includes also fodder crops in the form of sorghum and cowpeas, and it does allow of some return of organic matter to the soil. The crops grown during the November to March



Plate 3.

Irrigated Crops in the Lockyer Valley. Potatoes in foreground, lucerne being irrigated, and maize in background.

period in this rotation are maize, sorghums, cowpeas and sweet potatoes. The last two crops give a good vegetative cover, but row-cultivated maize and sorghums are less efficient in this regard. However, at no stage is there a bare fallow exposed to the heavy summer rains.

For practical purposes, dairy farmers would probably need to use both types of rotation, and in some circumstances a combination of both rotations may be desirable. The significant factor in each rotation is the inclusion of a pasture phase of at least five years' duration. There is little doubt that the use of a pasture phase would be most useful in conserving the soil and improving crop production.

Other Necessary Soil Conservation Practices.

On the slopes, rotations alone will not meet the problem completely and attention should also be given to contour farming and allied mechanical soil conservation measures.

Greater emphasis must also be placed by dairy farmers on fodder conservation, adjustment of stocking rates and rotational grazing to reduce the overgrazing of pasture paddocks. On slopes, overgrazed pasture in some circumstances can be just as susceptible to sheet and gully erosion of the soil as cultivated fields.



Plate 4.

Irrigated Crop of Young Onions, Lockyer Valley.

IRRIGABLE SOILS OF THE FLOOD PLAINS.

These soils are alluvial in origin, are brown to black in colour and vary in texture from loams and sandy loams at the heads of the valleys to clay loams and clays as the distance from the source of the streams increases. They are deep soils, but the drainage of the clays and clay loams is not all that could be desired. Sometimes they are self-mulching and in nearly all cases they have excellent water-holding capacity. High fertility is general, although cropping may lead to an overall deficiency of nitrogen, while potash is not well supplied in some soils along Laidley Creek. In addition, a deficiency of sulphur in some localities will retard lucerne growth if not corrected. The nitrifying capacity of the heavy soils is high and little response to nitrogenous fertilizers can be expected if a bare fallow of two to three months has operated prior to planting of the crop.

Generally speaking, these soils are used principally for the production of crops under irrigation, although some areas (where the water is unsuitable for irrigation) are used for dairying. Thus this land is kept continuously under one crop or another, and is worked frequently by cultivation implements. Consequently, some deterioration of the physical structure of the soil has occurred. The slope of these soils away from the creek banks is very slight and soil erosion is not a problem.

The factors responsible for the deterioration of structure on these soils are intensive cultivation; intensive spray irrigation on unprotected soils; frequent irrigation, in some cases with waters almost unsuitable for irrigation due to their salt content; the small return of organic matter; and the absence of a pasture phase in association with grazing animals in the crop rotations practised.

Crops Grown and Rotations Practised.

In their approximate order of importance, the crops grown are lucerne, onions, potatoes, pumpkins, maize, cowpeas, winter cereals and linseed.

These crops are grown in definite zones on the farms, and on the lighter soils of the creek banks a typical rotation would be:—

Lucerne	3 or more years.
Potatoes	Autumn crop.
Pumpkins	Spring crop.
Potatoes	Autumn crop.
Cowpeas	Spring crop.
Potatoes	Autumn crop.
Pumpkins	Spring crop.

In this type of rotation the emphasis is on the production of potatoes and lucerne primarily, while pumpkins enable a widening of the rotation. Cowpeas are included as a green manure crop in an attempt to keep the soil in a condition suitable for potatoes.

On the heavier soils the following is a common rotation:—

Lucerne	3 or more years.
Pumpkins	Spring crop.
Onions	Winter and spring.
Fallow	Summer.
Onions	Winter and spring.
Pumpkins	Summer and autumn.
Onions	Winter and spring.

In this rotation the onion crop is the first consideration, but lucerne is also given careful attention. The pumpkins are often planted as a catch crop, and are not given a great deal of attention. This rotation is operated so as to keep the land relatively free from weeds for the onion crop. Some farmers include a green manure crop in this rotation, and the practice is to be commended.

Maize, winter cereals and linseed are included in these rotations somewhat haphazardly, depending upon the need of the moment. In general, they do not figure very largely in the agricultural programmes of the irrigated soils of the flood plains. For the most part the rotations practised have given satisfactory results on these fertile soils and a good level of production has been maintained. In recent years the wider application of fertilizers has been beneficial, especially where the soils have shown response to the use of fertilizers containing potash, sulphur and nitrogen.



Plate 5.

Wheat Varietal Trial, Bureau of Investigation's Irrigation Research Station, Gatton. Wheat is used as a rotation crop in some parts of the Valley.

The use of lucerne in the rotations is most beneficial, particularly in favouring the build-up of soil nitrogen and in spelling the soil for a few years from intensive cultivation. This crop, however, does not function to any great degree in restoring soil structure and it is felt that more attention needs to be given in the future to introducing a pasture phase in the rotation for this purpose.

The irrigated pasture investigations at the Bureau of Investigation's Irrigation Research Station at Gatton have shown that irrigated pastures of high productive capacity can be grown on the flood plain alluvials. The inclusion of an irrigated pasture phase in the crop rotations would be desirable. The problem is to fit this



Plate 6.

Beef Cattle Grazing on Irrigated Pasture, Bureau of Investigation's Irrigation Research Station, Gatton.

phase into the routine of farms which are mainly devoted to crop production only. The use of grazing animals would be necessary if irrigated pastures were to be grown. There is little doubt, nevertheless, that a combination of both crop and animal husbandry would lead to greater stability and a permanently high level of fertility in these rich irrigated alluvials.

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No. 23. Beef production in association with cultivated crops.



The Banana.

J. McGREGOR WILLS (Senior Adviser in Horticulture) and F. W. BERRILL (Assistant Horticulturist), Horticulture Branch.

THE cultivated banana has a very respectable antiquity. Alexander the Great found it growing in India during the course of his campaign in 327 B.C., but the plant was well known in Egypt and Assyria at a much earlier date. The crop is linked traditionally with the Garden of Eden as the tree of knowledge of good and evil; hence the name (*Musa paradisiaca*) given by the early botanist Linnaeus to the species now commonly referred to as the plantain.

The banana is a more or less typical monocotyledon and belongs to the family *Musaceae*. In the earlier systems of botanical classification this family included not only the genus *Musa,* which contains both the cultivated and wild forms of the banana, but also the genera *Ravenala, Strelitzia* and *Heliconia.* Probably the best known member of *Ravenala* is *R. madagascariensis,* the traveller's tree of Madagascar, which is grown as an ornamental. The species of *Strelitzia* are natives of South Africa and produce rather curious and highly ornate "bird of paradise" flowers. *Heliconia* is somewhat rarer, being confined mostly to the West Indies and South America, where it is sometimes referred to as a wild plantain.

These three genera are now no longer classified with the true bananas, and the family *Musaceae* therefore contains only the true bananas, the cultivated seedless types being confined to the genus *Musa.* The family contains a comparatively large number of species widely spread over the tropical and subtropical regions of the world. Only three, however, are indigenous to Queensland, namely *Musa banksii, M. hillii* and *M. fitzalani,* all of which are seeded forms of no commercial importance.

The most widely grown commercial variety in Queensland is the Cavendish. In 1826 a few plants of this variety were taken from Southern China to Mauritius. In 1829 offshoots from these were sent to England and grown in the Duke of Devonshire's hothouses at Chatsworth. The owner's family name was Cavendish and hence the variety became known as *Musa cavendishii.* In 1838, plants were taken by the missionary John Williams from Chatsworth to the South Sea Islands, where their high-bearing capacity and low stature made them very popular. Since the plant reproduces itself only by vegetative offshoots, it is very probable that many of the Cavendish banana plantations established in Pacific countries originated from the plants owned by the Duke of Devonshire over a hundred years ago.

HISTORICAL DEVELOPMENT.

The commercial production of bananas in Queensland commenced independently and at different times in various parts of the State. On the extreme south coast, the first planting was made in the Currumbin district in 1903, the varieties being Lady Finger and Sugar, followed a little later by Cavendish. Prior to that time banana shipments from North Queensland to southern capitals were heavy, but Fiji captured these markets after the Leonta cyclone which crippled Australian production in 1903. Subsequent to large-scale plantings on the Tweed River in New South Wales, the industry spread to southern Queensland. In these early years the total acreage under crop was small, as payable markets were practically non-existent in Brisbane. The Sydney market was usually well supplied from Fiji and consignments of fruit to Melbourne often opened up in poor condition and showed considerable wastage. Nevertheless, the industry expanded slowly along Currumbin Creek to Tallebudgera, Mudgeeraba, Nerang, Coomera and adjacent districts.

On the Near North Coast, Buderim Mountain was opened up for settlement about 1867. Shortly afterwards bananas, mostly of the Cavendish and, to a lesser extent, the Lady Finger variety, were introduced, and the crop developed on a considerable scale, the fruit being carried to Brisbane by sea. At the same time, production began further north in the Gladstone, Rockhampton and Bowen districts. In the far north, however, production was well under way much earlier, the crop being grown on the alluvial flats, principally by Chinese settlers, and shipped to Brisbane.

The virus disease known as bunchy top was introduced into New South Wales with imported planting material, and after the initial outbreak in the Tweed River district reached Queensland in 1920. By that time the industry had expanded considerably and was estimated to be worth more than £1,000,000 to the State. In the absence of control measures for the disease, plantations south of Brisbane were virtually wiped out and the industry consequently came into much greater prominence on the north coast. In the late 1920's, control measures for the disease had been evolved and the south coast area again became an important producing centre.

PRODUCTION.

The banana is now an important food crop in most parts of the world between the latitudes of 29° N. and 29° S. In Queensland it is grown along the whole of the coastal strip from the New South Wales-Queensland border to Mossman, a distance of some 1,200 miles. Climatic conditions vary considerably within this area and production is influenced correspondingly. However, most of the crop is produced south of Gympie at the present time, mainly because of the close proximity of this area to the more important metropolitan markets of Brisbane, Sydney and Melbourne. In the year 1952-53, the total area of bananas in Queensland actually in production was estimated to be 8,707 acres.

STRUCTURE AND GROWTH HABITS.

The banana is a broad-leaved herbaceous perennial plant (Plate 1) which flourishes in warm, moist, sheltered situations exposed to neither high winds nor low temperatures, and having a well-drained fertile soil.

The Corm.

The true stem is a condensed rhizome known as a "corm," which remains underground for the greater part of its life. It is a thick massive structure with rudimentary or scale leaves. The roots arise mainly from the sides but also from the base of the corm. Suckers or offshoots are produced from buds in the axils of the scale leaves, which follow a spiral pattern, and sucker buds or "eyes" occur in pairs, the buds in each pair being almost opposite to each other on the corm. Thus vigorous plants tend to throw suckers of approximately equal age in pairs, the suckers in each pair being on almost opposite sides of the aerial pseudostem.



Plate 1.

Cavendish Banana Plant Bearing a Crop. Bunch at right about three weeks old; bunch at left about 10 weeks old.

Plant foods are accumulated in the corm not only for the maintenance of growth in the plant itself and its suckers, but also for the production of fruit. These reserves of food material are mainly starch. When an eye begins to grow, the insoluble starch in that part of the corm is rapidly converted to soluble sugars which are essential for the formation of new plant tissues. A similar process

takes place when the bunch is initiated. The vigour of a plant and its suckers, and the size and quality of the bunch produced, are related therefore directly to the amount of food material stored in the corm.

If the corm is cut in halves horizontally three distinct regions will be observed. Between the central, tough, white, fibrous portion and the outer surrounding tissue is a ring of somewhat transparent material from which the sap conducting vessels of the roots originate.

The Roots.

As in all monocotyledons, the roots are relatively long, cordlike and fleshy, do not thicken and form wood with age, and although tough, are nevertheless easily damaged. Near the ends of the main roots are the fine secondary roots known as hair roots. The actual



Plate 2.

Root Distribution of the Banana. Cavendish plant approximately six months old. Note the lateral spread of roots and depth of penetration. The box is 31 in. deep.

absorption of food materials from the soil takes place through very small root hairs which occur on roots of all sizes and are connected with the internal sap-conducting vessels of the root and hence to the corm.

In a moist but well-drained, deep, friable soil with a high humus content, the roots extend laterally for several feet from the base of the plant but are usually relatively shallow. The depth of penetration depends largely on the structure of the surface soil and the subsoil, but as a general rule, few roots go below the 30-inch level, and in many soils rarely if ever get even to that depth (Plate 2). Soils with a poor structure are associated with shallow root systems in the banana plant.

The Leaves.

The part of the plant commonly referred to as the trunk or pseudostem is made up of the expanded leaf bases which protect the younger leaves and the flower in their early stages and support them several feet above the ground.

The leaf proper consists of a midrib and broad undivided blade. It arises from the central growing point at the apex of the corm and is forced up through the pseudostem, finally emerging at the top or "throat" with the blade tightly rolled round the strong fibrous midrib. One side of the blade is slightly longer than the other and folds over to form a cap. When growth is vigorous, the young leaf does not unfurl until it is clear of the throat, but during cold or excessively dry weather unfurling may begin earlier and induce what is generally known as a compacted pseudostem.

The total number of leaves produced by a plant before it bunches varies from 30 to 40 or occasionally more. The last two leaves produced are shorter than those preceding them, the final one being extremely short and having a tendency to hang over the flower bud. In addition, the flower stalk itself bears one or more elongated sheathing structures called bracts, which shrivel and dry out soon after the bunch is thrown.

Flowers and Fruit.

The flower buds are initiated at the growing point of the corm and hence some are actually differentiated at or just below ground level (Plate 3). From this time onwards the corm elongates vertically to form an aerial stalk which carries the flowers up through the pseudostem in much the same manner as the petiole has carried its leaf blade to the top. The thickness of the flower ranges from 2 to 4 inches but its diameter varies with the vigour of the plant and the variety.

As the stalk elongates it carries up with it the last few leaves, whilst at its tip are the developing flowers. Apart from the elongation of the stalk and increase in size of the fruit, there is no further growth of the aerial portion of the plant once the flowers appear. As the stalk elongates, the weight of the fruit causes it to bend downwards, so that the bunch finally hangs vertically with the distal end downwards. The pseudostem and leaves quickly die when the bunch matures its fruit, but the original corm persists for some months before finally rotting away.

The flowers are grouped in double-row clusters known as hands. The hands are arranged spirally around the stalk, the number of flowers in a hand varying from 10 to about 25 or more and the oldest hands towards the base of the stalk generally have the greatest number. Each hand is subtended by a reddish-purple or green bract (the colour differs with the variety) and development proceeds from the base upwards, each bract in turn lifting to expose the flowers underneath.

Before the bunch begins to move up the pseudostem, each flower is potentially bisexual or hermaphrodite. Differentiation, however, takes place during development, so that commonly the opened flowers are described as female, hermaphrodite or male. The fully developed flowers at the base of the bunch have well developed ovaries, styles, stigmas and stamens, but the stamens have no anthers. This type of flower, which gives rise to the fruit, may account for 12 or more of the basal hands. In the flowers following these, the ovary is small and the

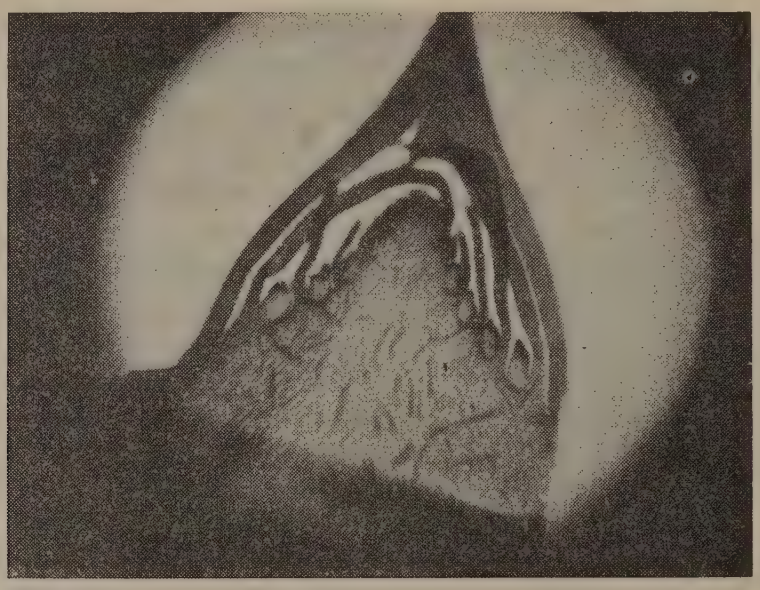


Plate 3.

Longitudinal Section Through Growing Point of Corm after the Bunch has been Initiated. Note the embryonic flower buds and the elongation of the apex, which will become the bunch stalk. The outermost structure is a section through an immature leaf.

stamens become more and more pronounced, until in the lower hands the flowers have normal anthers, whilst the female structures are imperfect. In the Cavendish variety the hermaphrodite flowers form a cluster of short rudimentary fruits, immediately below the last true hand of fruit; in the Mons Mari, these are mostly deciduous (Plate 4).

The cultivated banana is parthenocarpic—that is, the flowers produce fruit without being pollinated and the fruit is normally seedless. If, however, two varieties are cross-pollinated, seed may be produced; this method has been used for breeding new hybrids for disease resistance and other purposes.

Since the flowers are initiated at the apex of the corm, the number of flowers and hence the possible number of fruit is determined long before the bunch appears in the throat. The actual period before the bunch is initiated varies with the growing conditions, but as a general rule in southern Queensland the so-called initials or foundations of the bunch are laid down within about four months of planting. The availability of plant foods at that time therefore determines the total number of fruit which can be formed. During the later development of the embryonic bunch, however, both food reserves and climatic factors influence bunch development, and what was potentially a very large bunch may only be a poor one when it is thrown if it has developed under unfavourable climatic conditions.

A typical example of such an effect is the so-called "November dump" fruit which occurs in southern Queensland, generally in bunches thrown about November. Such fruit commences development in mid-winter, when cold air at the base of the plant tends to check the elongation of the fingers and may even prevent their development altogether. The result is a bunch with comparatively few hands and

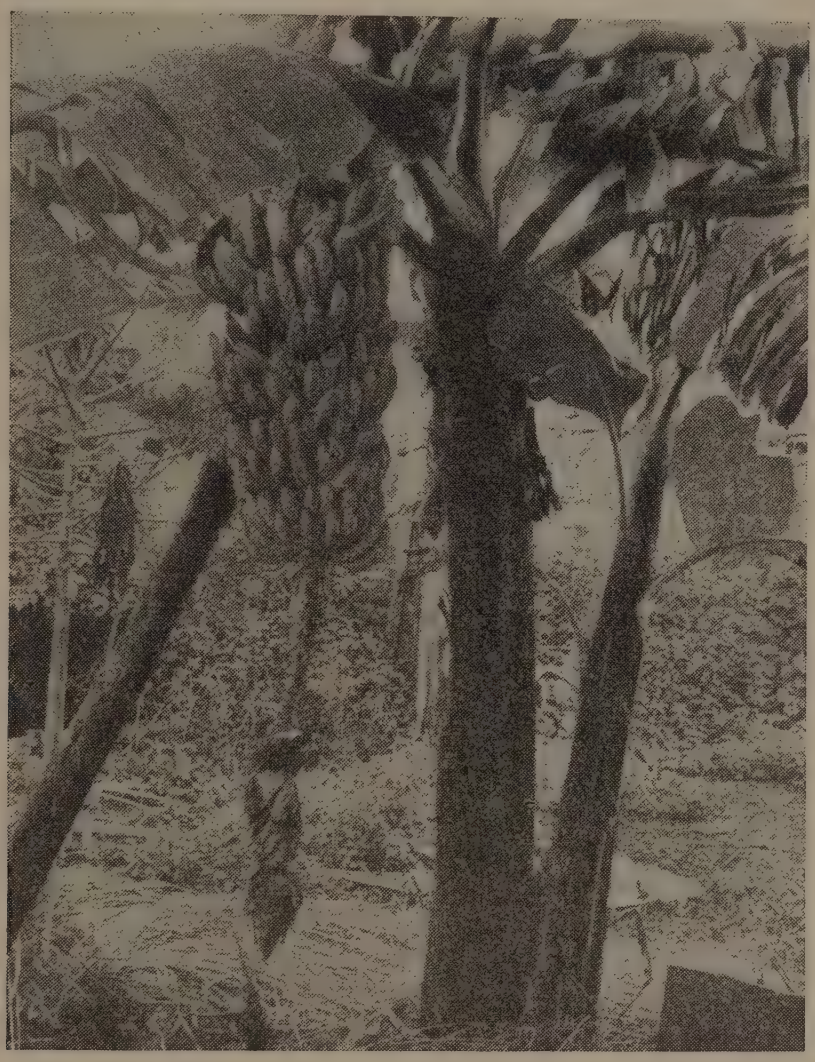


Plate 4.

Bunch Structure. A few rudimentary fingers derived from hermaphrodite flowers may be seen immediately below the last hand of fruit, with another cluster lower down the bunch stalk. At the extreme tip is the "bell" containing the male flowers.

very short fruit which become correspondingly fat and "dumpy" as they fill. Usually the more severe the winter, the worse are the "dump" bunches; the condition is not well known in the tropics.

VARIETIES.

The most popular variety grown commercially in Queensland is the Cavendish, a sturdy type which often escapes wind damage by virtue of its short pseudostem and which bears very heavy crops of fruit. In this country it is immune to Panama disease, which commonly affects tall-growing varieties, such as Lady Finger and Sugar.

The semi-dwarf Mons Mari and the very similar Williams Hybrid are bud mutations from the dwarf Cavendish, the former being first selected for commercial production at Buderim Mountain and the latter near Coff's Harbour in New South Wales. Mons Mari and Williams

Hybrid may attain a height of from 8 to 12 feet when grown on suitable soils. Under comparable conditions, the bunches are larger than those of Cavendish, the fruit grades better and the hands are more widely spaced. Furthermore, these mutants are often more tolerant of marginal soil and climatic conditions than Cavendish. They are generally preferred for commercial production at higher altitudes where Cavendish often proves least satisfactory.

The tall varieties, Lady Finger and Sugar, are generally grown on frost-free river flats. However, the severity of Panama disease in these areas has induced some growers to plant them on higher land which would normally be used for dwarf and semi-dwarf varieties such as Cavendish and Mons Mari. Provided the tall varieties are effectively protected from high winds by the topography of the plantation, they do well on the higher slopes. In the Near North Coast district, the Lady Finger is often planted on Cavendish replant land, mainly because of its relatively deeper rooting system, with quite satisfactory results.

The Anamalu, imported from Ceylon some years ago, is the tallest commercial variety grown in Queensland but production is still on a small scale. It attains a height of 16-18 ft. and can be grown either on alluvial flats or on slopes. However, owing to its great height, slender pseudostem and very large bunch, efficient propping is impracticable and heavy losses are inevitable if the plantation lacks good natural protection from strong winds. The fruit is particularly attractive, has an excellent flavour and carries well to distant markets.

The Gros Michel, although the most important banana variety in world commerce, is not grown commercially in Queensland, though isolated small areas still exist in the north of the State. Its lack of importance is due primarily to a marked susceptibility to Panama disease and its tendency to suffer severely from strong winds.

Other varieties which are grown in Queensland but of little commercial interest include Viemama, Red Dacca, Green Dacca (or Raja), Ducasses Hybrid, Blue Java, Lubin (or Bookabooka), Embul Hondrawala and the Common Plantain.

The main characteristics of the more important commercial varieties of banana in Queensland are given below (measurements given are only approximate) :—

Cavendish.—Pseudostem 6 ft. high; green but heavily pigmented. Leaves 5 ft. long and up to 24 in. wide; stalk short and sturdy. Bunch medium to large with 8-12 hands; compact and tapering. A very popular variety which is resistant to Panama disease.

Mans Mari and Williams Hybrid.—Pseudostem 8-12 ft. high; green but heavily pigmented; somewhat thinner than Cavendish. Leaves 6 ft. long and up to 26 in. wide; stalk moderately long and sturdy. Bunch long and cylindrical, with 10-15 well-spaced hands. Both are tall mutants from Cavendish and require propping.

Lady Finger.—Pseudostem 12-16 ft. high; bright green with little pigmentation. Leaves 8 ft. long and up to 28 in. wide; light green and slightly drooping; stalk long and sturdy. Bunch medium, with 5-8 hands of short, thick and rather angular fruit. A tall variety which is tolerant of cool weather and does not require propping; susceptible to Panama disease.

Sugar.—Pseudostem 10-12 ft. high; slender; light green; slightly pigmented. Leaves 6-7 ft. long and up to 24 in. wide; stalks long, slender and tinged with pink. Bunch usually small with 5-6 hands of short, thin-skinned fruit which has a sweet flavour. Very susceptible to Panama disease.

Anamalu.—Pseudostem 14 ft. high; tapering; light green with some pigmentation. Leaves 10 ft. long and about 30 in. wide. Bunch long and cylindrical, with well-spaced hands; fruit abruptly curved at base. Requires a sheltered situation as propping is impracticable.

SELECTION OF LAND.

Important factors in the selection of land for banana production are a rainfall of from 50 to 100 in. per annum, high soil fertility, and a subsoil which, while not impeding drainage, holds sufficient moisture to tide the plant over dry periods whenever they occur. These conditions are best satisfied by virgin soils (Plate 5) which have not been exploited for horticultural purposes and are therefore rich in plant nutrients, contain a large amount of organic matter and possess a good structure. Frequently, therefore, bananas are handled as a developmental crop which is planted on land to be used for other purposes when the cropping period for bananas has ended.



Plate 5.

Banana Plantation at Upper Coomera. Lady Fingers in left foreground; Mons Mari in near centre. Note the protection afforded by standing timber.

An exception occurs in the case of alluvial areas where irrigation can be applied from either river or underground sources of water (Plate 6). In North Queensland, dwarf and semi-dwarf varieties such as Cavendish and Mons Mari are grown frequently on alluvial soils, but in southern Queensland, tall varieties such as the Lady Finger are preferred on this type of country.

When selecting land, the natural vegetation is often a guide to its suitability for bananas. Potential banana soils occur in both rain forest and open forest associations. The rain forest or scrub soils are usually deep, friable loams, rich in humus and well drained. When derived from basalt they may be stony on the surface, but this is not a serious drawback as the stones impede surface runoff during heavy rains and therefore minimise soil erosion even on steep slopes. Dense vine growth and tall, straight softwood timbers such as carrabean, crow's ash, bolly gum and cedar are typical of this type of country.



Plate 6.

A Typical River Flat Plantation. With a long frontage to the tree-lined river, irrigation presents no difficulties.

Most of the rain forest in southern Queensland has already been cleared and it is difficult to find areas of virgin scrubland for bananas, except in relatively inaccessible situations at the heads of gullies or high up on mountain slopes. In Central and North Queensland, suitable land of this type is still available in quantity.

Scrub soils now under pasture can, if necessary, be utilized for bananas, provided the area is ploughable and can be prepared for planting at a reasonable cost. Slopes formerly used for bananas and now covered by lantana and sapling regrowth up to several years old may also be cleared and planted to the crop. In both cases, heavy applications of fertilizer will be needed for maximum production.

Open forest soils are normally less fertile than rain forest soils in coastal areas where bananas can be grown. However, if the land is selected carefully and the plantation managed efficiently, payable crops can be produced. In the open forest soils, trees such as bloodwood, grey gum and tallowwood, especially if accompanied by dense undergrowth, are indicators of a reasonably deep, well-drained, friable loam containing

fair amounts of organic matter. Open forest soils supporting mahogany, turpentine or spotted gum are usually shallow and erode rapidly if adequate precautions are not taken to prevent soil wash.

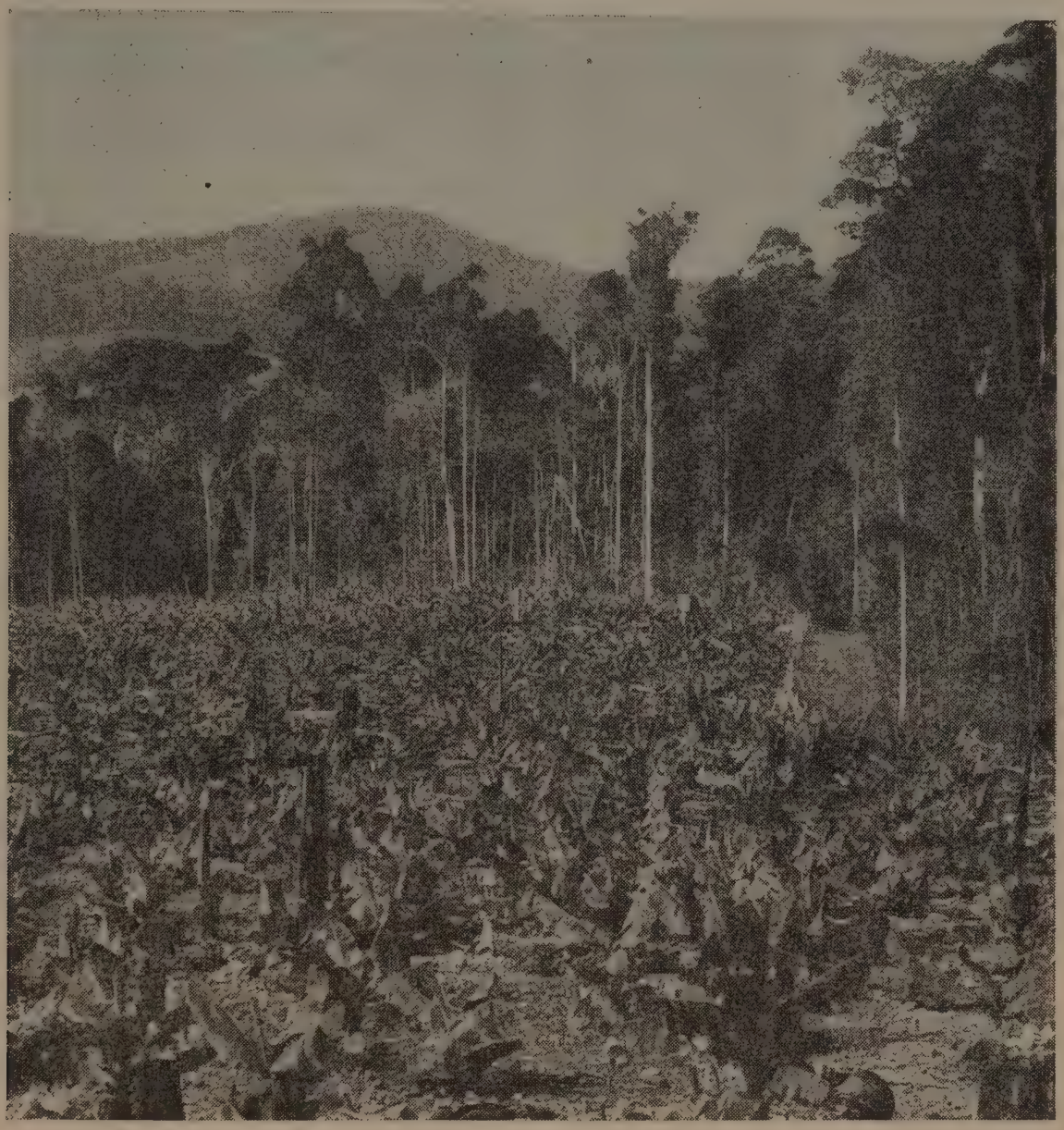


Plate 7.
Cavendish Banana Plantation, South Coast, on Virgin Rain Forest Land.

Alluvial soils vary considerably. Some are relatively heavy silts overlying a porous subsoil; others are heavy loams overlying clay. Except in very wet areas, the light alluvials are of little value for bananas unless the crop can be irrigated and fertilizers are regularly applied. The heavier alluvials are capable of producing good crops of bananas if care is taken to provide the requisite drainage.

SELECTION OF SITE.

The banana plant requires ample moisture and relatively high temperatures for its best development. Both are influenced by the elevation, aspect and natural shelter of the plantation area. Freedom from frost is essential, but tall varieties such as Lady Finger and Sugar are rather more tolerant of cold conditions than the dwarf and semi-dwarf types. This tolerance of cold conditions is mainly due to the rapid growth of the plants during the first year after planting; throat and leaves are well above ground level, where cold air accumulates at

night in the winter months. Such accumulation of cold air at the base of the stools may, however, be detrimental to plants with a bunch in the embryonic stage, for the size and quality of the bunch are affected.

In southern Queensland, where the frost risk is most serious, there is a rather distinct segregation of varietal plantings in terms of altitude, as follows:—0 to 1,000 ft., Lady Finger and Sugar; 400 to 1,000 ft., Cavendish; 400 to 1,300 ft., Mons Mari; 1,000 to 1,500 ft., Williams Hybrid. Sites affected by down-flowing currents of cold air from hills are unsuitable for bananas, as severe chilling in winter is associated with retarded plant growth, delayed bunching and severe fruit blemishes. Tops of ridges should not be cleared for bananas if wind damage is likely to occur. Except in North Queensland, where aspect is not important and planting on level ground is desirable, plantations should face from east to slightly west of north. Such aspects are naturally warm and moist, since they are open to the morning sun and protected from strong southerly and westerly winds by either topography or natural timber.

PREPARATION OF THE LAND.

In virgin rain forest or scrub, undergrowth is usually brushed and the standing trees are felled from April to June so as to allow ample time for the timber to dry out before burning between September and November. In open forest, clearing may be delayed until June or July, since most hardwood trees burn well within a few weeks of felling. In replant land, the lantana is brushed and young saplings are cut down about six weeks before the actual burn, when, if the day is calm and sunny, an effective clean-up can be expected. Old pasture land should be rough-ploughed across the slope during the early spring and as much grass as possible worked out of the soil before planting; blady grass or bracken must be grubbed with a sharp mattock to ensure its destruction.

Felling and Clearing.

In preparing virgin land for bananas, the undergrowth should first be cut close to the ground. As far as possible, trees should be felled across the slope, for scorched logs left in this position after the burn reduce soil drift down the slope. On relatively flat country this consideration is less important. A good burn can be expected only if all upright branches are lopped and stacked around the larger timber before starting the fires.

After burning off, the layout of the plantation should be finalised, planting distance selected, and, if the land is steep, the position of wiring systems fixed so that fruit can be conveniently despatched to the packing shed.

Contouring.

As bananas are very largely grown on steep slopes in the main producing areas, steps must be taken to minimise soil erosion by controlling the flow of surface water during periods of heavy rain. Contouring is, therefore, a necessary practice in many banana districts (Plate 8).

In preparing land for contour planting, it is first necessary to construct a contour drain above the proposed plantation site to divert surface water to a suitable outlet such as a grassed gully. Below this diversion drain the banana rows are marked out on near-contour lines with a fall of 2 in 100 and shallow drains about 12 in. deep are dug



Plate 8.
Contour Planted Bananas, North Coast District. The bananas have been planted six weeks.

between every two adjacent rows of bananas to carry surface water slowly from the plantation. These drains usually lead to the same natural runway as the diversion drain.

In new plantings, the plant rows are spaced at intervals of 9-14 ft., depending on the requirements of the variety to be grown.

An alternative method of marking out the area is to form the contour drains first and then set out rows between each pair of drains in the most practicable way. If the drains are several degrees off parallel, as they often are, it will be necessary to provide one or more short spur rows to maintain the required plant and row spacing. In order to avoid awkward spur rows, it is sometimes preferable to construct the contour drains and then plant the area on the square system, moving the stool position slightly uphill whenever it coincides with a drain.

In banana areas already established and not planted on the contour, it is still practicable to install cross drains to divert surplus water and reduce soil erosion. These drains need not necessarily follow the plant rows and may deviate from the normal fall in order to avoid the destruction of existing stools. The construction of such cross drains involves little labour and does much to prolong the life of the plantation.

RECONDITIONING OLD BANANA LAND.

Old banana land is often allowed to develop a natural cover of lantana, a plant which is usually slow to establish itself, difficult to remove when the land is required for replanting, and, furthermore,

very susceptible to attacks by the root knot nematode. A tall perennial legume, such as the pigeon pea (*Cajanus cajan*), which makes rapid growth when the bananas are eradicated and enriches the soil during the resting period, is much more effective (Plate 9).



Plate 9.
Pigeon Pea, a Reconditioning Crop for Old Banana Land.

If the plantation is to be dug out in winter, the crop is sown in the preceding September or October. The seed may be broadcast at a rate of 8 lb. per acre and then ploughed or rotary-hoed into the ground. On relatively steep slopes where implements cannot be used, the seed may be hand-hoed into the ground at a rate of approximately 16 lb. per acre. When the plants are 12 months old and the first crop of seed has been harvested, the pigeon pea is either disced or cut back to 18 in. above ground level. Regrowth will soon renew the ground cover and within a few months the plants will be 9-10 ft. high. The dense stand of pigeon pea effectively smothers out most weeds, but wild tobacco (*Solanum auriculataum*) can hold its own against the legume and should therefore be dug out when present. The crop may be left on the area for several years until the land is required for replanting.

When bananas are again to be planted, the pigeon pea is brushed to ground level about three months before planting begins. In this period the mulch decomposes fairly rapidly and planting should be relatively easy. Under no circumstances should the brushed material be burned. Any regrowth which appears after the bananas are planted can be grubbed out during routine cultural operations.

[TO BE CONTINUED.]

PLANT PROTECTION

Diseases of Potatoes.

R. B. MORWOOD (Formerly Senior Pathologist, Science Branch).

(*Continued from page 148 of the September issue.*)

OTHER WILT DISEASES.

Potato plants can wilt from causes other than the diseases already mentioned. Verticillium wilt is very similar to Fusarium wilt but is not of frequent occurrence in this State. Shortage of water can, of course, produce wilting, so also can excessive water when the soil is waterlogged for some days. As well as causing wilting of the plants, waterlogging may be responsible for rotting of the tubers. Complete loss of crop in lowlying areas is of not infrequent occurrence when heavy rains occur as the crop matures. At the other end of the growing period, waterlogged soils may induce rotting of seed pieces. This is more likely to occur at high temperatures and when cut seed is used. This accounts for the use of whole seed for sowing for the autumn crop, as in February and March soil temperatures are high and rainfall is liable to be excessive. Potatoes should be grown on a well-drained site and growers should at least attend to surface drainage so that water does not stand between the rows of potatoes after heavy rain.



Plate 7.
Common Scab.

SCAB.

The disease of potatoes most frequently occurring in Queensland is common scab. It affects only the tuber, producing cracked and scaly areas and depressions on the tuber surface (Plate 7). The infection does not penetrate deeply and there is little direct loss of the edible portion. However, scabby potatoes will not keep, as the affected areas allow the entrance of rot organisms which soon cause breakdown during storage. On this account, as well as because of their unsightly appearance, all scabbed potatoes should be sorted out when digging, and no attempt should be made to dispose of them by sale in the ordinary way. They may be used for pig food.

Scab is caused by a lowly fungous organism (*Actinomyces scabies*). It forms a delicate surface growth, and the scab is the potato's reaction to the irritation of the fungus. The organism is introduced on seed potatoes and survives in the soil for a number of years. It is serious on land having a neutral or alkaline soil reaction, and the acidification of the soil with sulphur has been advocated for its control. The process, however, is somewhat expensive and it has not been extensively practised.

Control.

(1) Rotate crops. If sufficient potato land is available only one potato crop should be grown in the soil and then it should be planted to lucerne or other crops for three or more years, when potatoes can again be planted.

(2) Use seed free from any obvious signs of scab.

(3) Treat the seed to eliminate the scab organism. The most convenient treatment available at present is dipping in a solution of one of the commercial organic mercury compounds, such as Aretan, Baytan and Mertan. Directions for the use of these are printed on the containers. Another method of treatment is that of using acid corrosive sublimate. Directions for this method can be supplied if required.

BLACK SCURF OR RHIZOCTONIA SCAB.

A second type of scab of the potato produces small black lumps on the surface (Plate 8). These lumps resemble black soil, but may be distinguished by the fact that they cannot readily be washed off. They are an intense black colour when wetted, and are the sclerotia or fungus resting bodies, which revive when the tuber is planted in moist soil. The fungus (*Corticium solani*) then produces a mould-like growth which attacks the stalks of the plant about ground level. The affected stalk rots away, or, if dry weather supervenes, it shrivels and the top of the plant dies. A common feature of this phase of the disease is the production of aerial tubers. These take the form of swellings on the stems of the plant, resembling tubers but being green, soft and useless.

The control of this disease consists in taking the same precautions as are used to prevent common scab, including crop rotation, seed selection, and seed treatment.

VIRUS DISEASES.

The diseases considered so far are caused by fungi or bacteria. The effects of these pathogens are readily observed as conspicuous spots or obvious wilting and death of the plant. The virus diseases, on the

other hand, are often overlooked by the grower, but nevertheless they seriously reduce the crop yield. They usually produce an abnormal appearance, such as stunting of the plant, rolling, crinkling, yellowing, or mottling of the leaves, and the development of numerous close-set



Plate 8.

Rhizoctonia Scab.

shoots. These diseases are sometimes known as degeneration diseases and ascribed to run-out seed. In a general sense that is correct, but the running-out is due to the spread of the diseases to a greater extent in each succeeding crop planted from unselected seed. These diseases are actually caused by a virus or infectious agent, individuals of which are so small that they cannot be seen even with a high-powered microscope.

The virus usually spreads through all parts of the plant, including the tubers. When such tubers are used for seed, the resulting plant is infected from its inception. The disease will then spread to other plants, being carried by insects such as aphids which suck the sap from diseased plants containing the virus and subsequently turn their attention to the healthy ones. Plants affected by this secondary spread of the disease show the symptoms only in those leaves which are developed after infection takes place and little direct loss results. However, the virus may travel down into the tubers, which are then a potential source of serious disease in the subsequent crop.

The four diseases next discussed are the most important virus diseases of potato in this State.

Mosaic.

Mosaic is actually a group of diseases which are distinguished from each other only with difficulty. The appearance of a lightly affected potato plant is not very different from that of a healthy plant,

but the disease is readily recognised in a badly affected plant or if an affected plant is seen growing among a number of healthy ones, when its debilitated appearance is evident by contrast. The principal symptoms are a crinkling and yellow mottling of the leaves, with more or less stunting and bunching of the plant. The yield is considerably less when plants are severely affected.

Leaf Roll.

As its name suggests, the principal symptom of leaf roll is a rolling inwards or curling upwards of the leaflets (Plate 9). The leaves are abnormally thickened, stiff, and pale in colour. The stiffness serves to distinguish plants affected with leaf roll from those whose leaves have curled due to the effects of dry weather, wilt or other diseases of the stem which interrupt the supply of moisture to the tops. The tubers on a leaf-roll plant are fewer in number and smaller in size, but are otherwise no different from those of a healthy plant.



Plate 9.

Leaf Roll.

Control of Mosaic and Leaf Roll.

An infected plant cannot be cured, and no spray is of use either as a cure or as a preventive. Control therefore consists in the use of disease-free seed. Disease-free seed is obtained in the first instance by planting seed carrying a low percentage of infection in a small stud plot in a locality in which virus diseases do not spread rapidly. This plot is carefully rogued for the elimination of diseased and other undesirable plants. The resultant tubers are used to plant a larger

area and by selection and rogueing a supply of good seed is built up. Once it is established, disease-free seed is used for the stud plots, but constant attention is still necessary to maintain the standard. Such seed produced with adequate precautions under Government supervision is known as certified seed.

Queensland is dependent on the southern States for its main seed supplies. From this source Government certified seed may be obtained, and the use of such seed is an effective safeguard against losses from the common virus diseases. Certified seed is also superior in general agronomic characters such as trueness to type.

Purple Top Wilt.

This disease is very serious in the autumn crop in the Lockyer Valley in some seasons. It is a virus disease caused by the same virus as big bud in tomatoes and affects many crops and garden plants and also a number of weeds. On infected plants the young leaves are rolled and have a purple tinge most pronounced at the bases of the leaflets (Plate 10). The plant may wilt or develop a bunchy appearance, with



Plate 10.
Purple Top Wilt.

aerial tubers in the axils of the leaf stalks. Normal tuber formation is reduced and any tubers formed may be soft. The disease is spread by insects and difficult to control. There is some reason to believe that later-planted crops are less affected than early ones and that crops on soils with adequate organic matter show less effect of the disease than those on deficient soils. Investigations are being made into this disease and further information may be available later.

Spotted Wilt.

Spotted wilt is more generally known as a disease of tomatoes, but it attacks a wide range of plants, including potato. It can be recognised by the presence of spots or necrotic areas on leaves and stems. The spots are very like those of target spot but they appear on the youngest leaves first and are sometimes seen as a small ring surrounding an island of green tissue (Plate 11). It can affect the plant very seriously and in the cooler southern States affected plants frequently form few if any tubers. In Queensland the disease does not usually affect the plant so severely, tuber yield being only moderately reduced.



Plate 11.
Spotted Wilt.

PHYSIOLOGICAL DISEASES.

In addition to the infectious diseases of the potato, there are a number of diseases caused by conditions under which the crop is grown. The exact nature of these conditions is not known in all cases, but it is fairly well established that the physiological diseases do not spread in the way that the fungous, bacterial and virus diseases do.

Black Heart.

Tubers affected with black heart are quite normal on the outside, but on cutting are seen to have a black irregular area in the centre. Black heart is caused by overheating or poor ventilation in storage, and can be prevented by providing better storage conditions.

Hollow Heart.

Hollow heart is not discernible on the outside of the tuber, but consists of an irregular hollow in the centre of the potato. It is caused by too rapid growth and is not of any particular consequence.

Brown Fleck.

As with the two previous diseases, potatoes affected with brown fleck are normal on the outside. They have, however, scattered through their substance a number of small, hard, brown portions of tissue (Plate 12). The affected portions do not soften on cooking, and if at all numerous entirely spoil the potato. There are no parasitic organisms present in the brown tissue. The cause is not definitely known, and consequently no means of cure or prevention can be devised.



Plate 12.
Brown Fleck.

Glassy End.

In tubers affected with glassy end, the central portions, more particularly towards the stem end, are watersoaked and have a translucent glassy or greasy appearance. The affected area looks dull in contrast to the crisp white appearance of a cut healthy tuber. Such tubers are frequently referred to as being soapy. The affected portions are deficient in starch, and when cooked rapidly break down into an unpalatable mush. The trouble is caused by interruption in the regular development of the potato plant after the tubers have commenced to form. If the plant receives a check in dry weather the tubers will stop growing. When rain falls it may start into secondary growth or other tubers may form. In either case the earlier-formed tubers or portions of tuber give up some of their starch content to the fresh growth, resulting in the trouble under discussion.

GENERAL CONSIDERATIONS.

The average yield of potatoes in Queensland is low, partly due to climatic and soil conditions and partly due to losses from pests and diseases. To avoid the loss from disease every grower should:—

(1) Select a well-drained, friable soil for the crop.

(2) Rotate potato lands with other crops, such as lucerne, maize and pumpkins.

(3) Grow a variety resistant to Irish blight.

(4) Use certified seed.

(5) Treat the seed with one of the fungicidal dips.

(6) Plant at the correct time for the locality.



Farm Mechanisation Field Day. Interest is shown in bulk-handling equipment for grain.



Farm Mechanisation Field Day. Farmers watch a mass ploughing demonstration by a team of tractors.

Cutworm Control in Field Crops.

A. W. S. MAY, Entomologist, Science Branch.

SEVERAL species* of cutworms periodically infest field crops in many parts of Queensland, and when pest numbers are large, severe damage results. Infestation occurs at various stages of plant growth, and in older crops may lead to partial defoliation with the inevitable reduced yields. It is more usual, however, to associate these pests with newly germinated crops, particularly in autumn and early spring, when they may be responsible for reduced stands.

A wide range of plants furnish suitable food for these pests. In addition to most field crops, including lucerne, cotton, cereals, onions, potatoes and tobacco, many pasture grasses and weeds may be attacked. Weeds along headlands or in old cultivation often provide the site for the initial infestation which later moves to adjacent crops. Under some conditions cutworms show a preference for weed growth within a crop but later attack the crop when the weeds have been consumed.

All cutworms are larvae or caterpillars of night-flying moths, which are drab-coloured, stout-bodied insects with a wingspread of up to $1\frac{1}{2}$ in. The eggs are laid in batches in the moist soil at the base of food plants. On hatching, the young larvae disperse before settling down beneath a convenient host plant. They hide in the soil during the day, coming out to feed at night. For a time the young larvae merely erode the leaf tissues, but with increase in size they develop the true cutworm habits of cutting through the stems of seedlings and pulling the leaves down into the soil, where they are eaten. The duration of larval life is from one to two months. When mature, the cutworm forms an earthen cell and turns into a shining brown pupa or resting stage from which the moth emerges to complete the life cycle.

The Timing of Control Measures.

As cutworms approach maturity their capacity for food increases rapidly, and damage may not become obvious until the infestation is well established. Therefore, once the presence of these pests is noticed prompt implementation of control measures is necessary. Failure to check an infestation in its early stages may mean the complete loss of a stand at a time when replanting is not feasible.

Control Measures.

Where spraying machinery is available, cutworms can be checked rapidly and effectively. **DDT, preferably in the emulsion form, applied at the rate of one-half pound of active ingredient per acre, is the most effective insecticide for this purpose.** At this rate of application, one gallon of 25% DDT emulsion contains sufficient of the active ingredient to treat five acres of crop.

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* *Euxoa radians* (Guen.), *Agrotis ypsilon* Hfn., *Agrotis infusa* (Boisd.), *Mocis frugalis* F.

Should spraying equipment be unavailable, the broadcasting of a poison bait throughout the infested area will give good results. Baits may be prepared and used as follows:—

Thoroughly mix 25 lb. bran and 2 lb. BHC 4% dust (0.5% gamma isomer), and immediately prior to use dampen with 2 gallons of water to which 1-2 quarts of molasses have been added. One pound of Paris green or 2 lb. of lead arsenate may be substituted for the BHC dust. The bait, when ready for use, should be crumbly and not over-moist and is best applied in the late afternoon. For general broadcasting on a crop, the quantity of bait mentioned will prove sufficient to treat half an acre.







Plate 1.

Caterpillars and Moth of the Cutworm Agrotis infusa.



Plate 2.

A Poor Stand of Wheat Caused by Cutworms.

Where the cutworms are moving into a crop from adjacent cultivation or pasture, spraying or baiting a broad strip ahead of the larvae will prevent infestation. If a seedling crop has been damaged to the extent that resowing is contemplated, it will be necessary to destroy the cutworms in that field before the new crop is sown.

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Drawn from ..... bags
Representing a total of .....
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SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

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TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 15th SEPTEMBER, 1953.)

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	W. G. Marquardt, "Springlands," Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," M.S. 195, Pittsworth
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	C. A. Edwards, "Grasmere" Jersey Stud, Woodford
Polled Hereford	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla

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Some Aspects of Dairy Calf Management.

J. G. YOUNG, Husbandry Officer, Cattle Husbandry Branch.

THERE are several methods of rearing dairy calves, some of which are capable of considerable modification to suit local conditions and to satisfy local needs.

In the main, the system finally adopted in any area or on any particular farm depends on the feeds available and the alternative markets or uses for those feeds. The selection of a particular method is, therefore, largely an economic problem.

Irrespective of the method of rearing adopted, there are certain practices and precautions which are not only desirable but which in very many instances determine the success or failure of the calf-raising programme. These are concerned chiefly with management and hygiene, and unfortunately are frequently neglected on dairy farms.

IMPORTANCE AND FUNCTION OF COLOSTRUM.

Nearly all dairymen are aware of the importance of the first milk or colostrum and some have experienced the difficulty in rearing a calf which, for one reason or another, has not had at least one feed of this first milk.

Many farmers, however, are not aware of the reasons for the benefits derived by the calf from colostrum. They still regard its chief function as that of a laxative needed for the removal of the meconium, the original material discharged from the newborn calf's bowels.

The main function of the colostrum is, however, that of conferring passive immunity against disease on the young calf. Without this immunity, most calves would succumb to infection by disease organisms. The immunity derived is passive and temporary but bridges the gap until the calf is able to develop its own active immunity against disease infection later in life.

The establishment of passive immunity is associated with and dependent upon the presence of chemical substances called "antibodies" in the colostrum which are lacking from the blood of the calf at birth. The concentration of antibodies in the colostrum rapidly diminishes after the birth of the calf. Furthermore, the ability of the calf's digestive tract to absorb antibodies into the blood stream rapidly

decreases after birth, until by the second or third day of life absorption of antibodies by the calf is not possible nor is their concentration in the colostrum then very great.



Plate 1.

Colostrum is Essential to Keep Young Calves Healthy. It is best supplied direct from the cow.

It is, therefore, essential that the calf receives colostrum in the first day of life, and preferably direct from the cow so that risk of contamination is eliminated.

The function of colostrum in supplying the calf with vitamins, especially vitamin A, is also of great importance. Colostrum often contains 10 to 20 times as much of the essential protective vitamin A as ordinary milk. This is significant in view of the fact that calves at birth have a low level of vitamin A in their bodies.

A dietary deficiency of vitamin A, besides being responsible for certain eye disorders and chronic changes in the lining of the respiratory and digestive tracts, has as a widespread effect a loss in bodyweight and a decreased resistance to disease. Vitamin A is essentially a "protective vitamin".

Calves up to the age of one month, or at least until they are old enough to consume appreciable quantities of pasture or meal, depend on their milk ration for this essential vitamin, and the value of milk in supplying it in turn depends on the vitamin A content of the feedstuffs fed to the cow. The vitamin A in milk is entirely in the fat fraction (compare vitamin A values of butter and skim-milk in Table 1) and the content varies greatly in accordance with the content of the feeds consumed by the cow.

Variations in vitamin A intake do not materially alter the cow's milk yield but profoundly influence its quality in respect of this vitamin.

Table 1 illustrates the relative vitamin A potency of a number of common feeds. It will be readily seen that green pastures and good hays are the only readily available sources. Concentrates, in general, are entirely lacking in this vitamin.

TABLE 1.
VITAMIN A POTENCY OF VARIOUS FEEDS.

Feedstuff.	Vitamin A Potency.
Good Lucerne Hay (Green and Leafy)	†† to †††
Poor Lucerne Hay	0 to †
Good Cereal or Grass Hay	† to ††
Cereal Straw	0
Lucerne (at Grazing State)	†††
Grasses (Green and Actively Growing)	†††
Grasses (" Standing Hay " Stage)	0
Maize Grain (Yellow Varieties)	†
Maize Grain (White Varieties)	0
Oat (Grain)	0
Wheat (Grain)	0
Wheaten Bran	0
Linseed Meal	0
Meatmeal	0
Skim Milk	0
Butter	†† to †††
Livermeal	††
Cod Liver Oil	††††

It is becoming increasingly evident that many dairy calves in Queensland are reared on an inadequate vitamin A diet, especially when the cows are being fed heavily on concentrates during the late winter and spring months. The position is further aggravated during this period by the almost total absence of the vitamin in the natural pasture.

During the winter and spring months, and at other times when the herd diet is likely to be low in the vitamin, calves up to the age of one month and receiving a ration of wholemilk daily should be given a small daily supplement rich in vitamin A, such as cod liver oil or shark-liver oil. Some proprietary preparations of these materials are available; they should be used as directed, since some variation in their vitamin A potency occurs.

The oils can be fed together with the milk at the normal feeding times, but thorough cleaning of the calf-feeding buckets will be needed to remove the "fishy" odour. Alternatively, the calves can be periodically dosed with the oil.

If green and growing pasture or good hay is available at the age of four to five weeks, then the addition of the supplement can be gradually discontinued. A supplement such as this should always be fed to young calves when skim-milk and meals are substituted for wholemilk at an early age or when any of the "limited wholemilk" methods of feeding are used.

Losses from scours and pneumonia can, in very many instances, be much reduced by the use of a vitamin A supplement and greater liveweight gains achieved in the young stock.

HYGIENE IN THE CALF PEN.

Once the calf has been removed from the dam, usually after one or two days (and there is little point in leaving the calf with its dam for a longer period than this), it is often exposed to serious infection

by being placed, together with other calves of various ages, in a permanent calf pen or small paddock which in many cases has been used solely for this purpose for years.

Heavy concentrations of worm eggs build up in the soil in these situations and there is also an accumulation of organisms causing scours and other diseases. Many failures in calf rearing can be directly attributed to the unhygienic single calf pen or small bare or weedy paddock.

A good percentage of calf ailments can be avoided simply by regularly moving the young calves onto clean ground.



Plate 2.
Well Grassed Paddocks Assist in Maintaining Maximum Growth Rate in Calves.

The most desirable management method of achieving this is by providing a series of small grass paddocks so that individual paddocks may be spelled for at least one month before being restocked with calves. For preference, the stocking period should not exceed one week, so five small paddocks are needed to achieve a stocking period of one week and a spelling period of four weeks.

Under most circumstances in Queensland dairying areas, the provision of such a series of calf paddocks to allow regular monthly spelling could not be described as "rotational grazing" but rather as "rotational stocking".

The primary objective of rotational grazing is to supply the calves with a regular and continuous supply of young palatable pasture of high nutritive value, with the control of worm infestations playing a rather secondary and incidental role. For instance, where a pasture containing mixed clovers and fine-stemmed grasses is available, as in areas where a good winter and spring rainfall occurs or where pastures are irrigated, then supplementary feeding of the calves can be largely eliminated and they can be weaned from milk at a comparatively early

age by adopting a good fast rotation method. Under these good pasture and management conditions, the best growth increases are obtained in the young stock and worm burdens are kept at a minimum.

In most of the dairying areas of Queensland, however, the available native grasses can be maintained in a young and nutritious stage for only a comparatively short period in the summer. During most of the year the grasses are mature or in the "standing hay" stage. Under these circumstances, the control of internal parasites is likely to be the more important result achieved.



Plate 3.

Healthy Calves Go Hand in Hand with Hygienic Surroundings.

During recent years more and more attention has been focussed on the losses caused to dairymen by the ravages of internal parasites in their young stock. Winter and spring months almost invariably reveal many calves suffering extremely heavy worm infestations, with resulting cessation of growth and at times heavy mortality.

One of the principal keys to successful calf rearing is the regular movement of young calves onto clean ground to which cows and other calves have not had access for at least four weeks previously.

If fencing materials or other facilities are not available, or subdivision is impracticable for any other reason, then much can be achieved by using dog collars and dog chains attached to a heavy-gauge wire staked at each end. A calf secured by a leather collar and attached to a 6-ft. dog chain running along such a wire 50 yards long has access to about one-twentyfourth of an acre, and if it is moved weekly, this area is ample. Such wires can be readily moved. In addition, should an infection break out amongst the calves, suitable isolation methods are ready to hand and the risk of spread and possible losses is reduced to a minimum.



Plate 4.
Subdivision and Rotational Grazing Help to Control Worm Infestation in Calves.

The annoying task of having to unwind chains which have become wrapped around the anchor stakes can be avoided by inserting porcelain electrical insulators or other suitable "keepers" or "blocks," over which the hook of the collar and chain cannot pass, at appropriate intervals in the "trail" wire.

If direct tethering to a stake is practised, the same problem of the calf winding itself onto the stake can be eliminated by fixing the stake through the centre of an old wheel and attaching the chain to the rim or a spoke of the wheel.

The main disadvantage in any method involving tethering is the difficulty of providing shade and water facilities for each calf, whilst the advantages are that it can be implemented without much delay on most farms and without much capital outlay. In addition, it allows the provision of clean unfouled ground for each calf at regular periods, together with an effective system of isolation and reduction of the dangers of cross-infection.

IMPORTANCE OF CORRECT FEEDING METHODS.

The feeding of the correct quantity of wholemilk to young calves is particularly important. In general it should not exceed 10% of the bodyweight of the calf. This is the standard American recommendation and applies equally well under Queensland conditions.

For example, Jersey calves at birth weigh on the average 50 lb. liveweight, with the calves of heifers weighing nearer to 40 lb. bodyweight, so that, generally, Jersey calves in their first week should not receive more than half a gallon of wholemilk per day. Likewise, A.I.S. calves at birth vary usually between 75 lb. and 90 lb. liveweight, and their wholemilk intake, especially during the first week of life, should not exceed 8 lb. (6 pints) of wholemilk daily.

Table 2 is a guide to the average birthweights of the common breeds and the relative quantities of wholemilk to be fed in each case during the first week.

TABLE 2.

Feeding Wholemilk to Calves.

Breed.	Average Birthweight. (Lb.).	Milk Fed Daily in First Week.	
		Pounds.	Pints.
Jersey	45–55	5	4
Guernsey	55–65	6	5
Ayrshire	65–75	7	6
Illawarra	75–90	8	6

Calves fed excessive quantities of milk are likely to develop digestive disorders and consequently to be predisposed to infection by the numerous organisms carrying disease.

If the calf is well and there are no signs of scours, the quantity of wholemilk fed should be increased by 1-2 lb. above these rates during the second week and by a further 1-2 lb. during the third week. An increase in liveweight of 1-2 lb. is all that can be expected during the first week. This rate of liveweight increase should gradually increase until by the end of three months the calves are gaining weight at the rate of about 1 lb. per day. This increase will not be achieved unless the calf has received no setbacks from digestive disorders or other disease conditions.

In many instances, dairymen, in their efforts to rear their calves as well as possible, make available to the calf more milk than the animal's digestive apparatus can safely handle at one feed and as a consequence do considerable harm to the calf and subject it to much digestive disorder.

If the appetites of calves can be kept sharp, without the animals being starved, then thriftier and healthier calves will invariably result.

TICKS ON YOUNG DAIRY STOCK.

Although ticks can now be effectively controlled with a minimum of interruption to shed routine and milk yield by means of portable plants capable of use either in the bails or adjacent to the shed, there are still many instances where the young stock are neglected in this connection. This especially applies to young animals between weaning and first "freshening," when they are often relegated to a more or less remote "dry" paddock and seen only at irregular intervals.

Then, again, young calves still being fed milk in one form or another are often allowed to become heavily infested with ticks while the producing units of the herd, the milking cows, are kept reasonably clean.

Economic losses are caused in young dairy cattle through the worry and discomfort occasioned by the presence of ticks, and in the aggregate these losses are considerable. In cases of severe infestation there may be complete cessation of growth. In any case, considerable interruption to the feeding routine of the young animal occurs from the presence of even a relatively small number of ticks.

The reduced growth rates, inefficient utilization of feeds and resulting economic losses from tick worry on young animals are difficult to estimate with accuracy but are obviously of considerable magnitude on some farms.

In addition to the losses brought about by tick worry, a considerable leakage of nutrients occurs when the engorged female ticks drop off the beast. Each female adult tick removes about 1 cubic centimetre (10-12 drops) of whole blood, while 1,000 such engorged females remove about a quart of whole blood and take in blood proteins the equivalent of the protein in 2 lb. of cereal grains or about $\frac{1}{3}$ lb. of meatmeal. In addition, phosphate, calcium and other essential bone and body building minerals are removed; phosphorus is deficient to some extent in many Queensland dairying areas.

Degree of Infestation.	Estimated Number of Engorged Females Dropping per Week.
Light	500
Moderate	1,000
Heavy	5,000
Very Heavy	10,000

The control of ticks on the young growing dairy stock is essential if efficient utilization is to be made of the feeds and pastures available and if high growth rates are to be maintained.

DRINKING WATER FOR CALVES.

Many dairymen neglect to provide an adequate supply of drinking water for young calves, apparently assuming that while they are being fed milk their liquid requirements will be adequately met from this source.

When young calves have their feeding periods restricted to two a day they will develop a considerable thirst between feeds, more particularly in hot weather, with the result that milk fed from the bucket is consumed at an even faster rate than normally and the risks of digestive disorders are greatly increased.

Speaking generally, calves fed milk should drink the milk to satisfy a hunger rather than to satisfy a thirst. Their thirst should be satisfied by periodic drinks of water between feeds.

Calves after one or two weeks will begin to drink water between their milk feeds, and by the age of six weeks may drink a gallon or more each day. The actual quantity depends to a considerable extent on the day temperature and the availability of suitable shade.

Calves given access to dry meals or hay will usually eat very small quantities of the concentrates before going to the water supply, and generally repeat the process several times before consuming their quota of grain or meal. For this reason, the grain or concentrate box is best located in a shady spot adjacent to the water supply.

Water is particularly important should the milk intake be temporarily reduced or even suspended during a bout of scouring. In fact, many early cases of scours, chiefly dietetic scours, can be alleviated by the complete withdrawal of the milk ration for a period of 24 hours and the substitution of water. The calf can then be brought back onto its milk ration gradually, increasing the quantity each meal until the full ration is restored after two or three days. Calves while scouring suffer considerably from excessive loss of water from the body.



The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page* 163 *of the September issue.*)

Blue Gum.

Botanical Name.—*Eucalyptus tereticornis* Sm. This species has sometimes been called *Eucalyptus umbellata* (Gaertn.) Domin.

Other Common Names.—Forest red gum, red gum, red iron gum and Queensland blue gum.

Distinguishing Features.—This is a tree (Plates 45-47) with smooth light-grey bark with darker grey patches, narrow drooping leaves, buds with a long tapering, somewhat curved lid, and a rounded seed-capsule with prominent incurved valves.

Description.—A tree, sometimes as high as 100 ft., with smooth light-grey bark with darker grey patches, often grey and flaky towards the base. The leaves droop from the twigs and are long, narrow, and mostly curved, mostly more than 3 in. long and several times longer than wide. The flowers are produced in stalked bunches amongst the leaves and are about $\frac{3}{4}$ in. wide when fully out, each on its own stalk. The buds have a short, cup-shaped base and a long, tapering, curved lid. The seed-capsules are rounded, about $\frac{1}{4}$ in. or a little less in diameter, the upper part being composed of four or five triangular valves curved inwards so that their sides and tip are nearly touching.

Distribution.—Forest country and alluvial flats, but comparatively uncommon in the Darling Downs District. It often grows with apple (*Angophora subvelutina* F. Muell.) on alluvial flats. It is widely distributed in eastern Australia, chiefly in coastal and subcoastal districts.

Usual Flowering Time.—July-November.

Importance as Source of Honey.—Minor, occasionally medium.

Importance as Source of Pollen.—Major.

General Remarks.—The well-known and widely distributed blue gum is a most important species, and those areas in which it is plentiful are favoured as districts in which to place apiaries. Valuable



Plate 45.

Blue Gum (Eucalyptus tereticornis). Leaves, buds, flowers and seed-capsules.

pollen and nectar supplies are obtained regularly from it during late winter and early spring. This stimulates colonies to breed freely and build up in strength quickly, thus ensuring that the following major spring and summer nectar flows are worked fully. In addition, some beekeepers report that during a good season a colony may yield up to 40 lb. of predominantly blue gum honey.

Trees of this species bloom more or less each year, although about every three or four years a heavy flowering occurs. On such occasions many spring and summer honeys marketed from coastal districts contain noticeable amounts of blue gum honey.

The reasonably dense honey has a pleasant but characteristic flavour somewhat resembling that of caramel or toffee. Its granulating qualities are unknown, as pure samples are not often encountered.



Plate 46.

Blue Gum (Eucalyptus tereticornis). Portion of trunk.

River Red Gum.

Botanical Name.—Eucalyptus camaldulensis Dehn. This species was widely known in the past as *Eucalyptus rostrata* Schlecht., but this name had previously been used for a very different tree.

Other Common Name.—River Gum.



Plate 47.

Blue Gum (Eucalyptus tereticornis). Mandalay, near Brisbane.

Distinguishing Features.—This is a tree (Plates 48-49) with smooth white bark (except near the butt), narrow drooping leaves, rounded buds with a distinct, sometimes rather long point, and seed-capsules with gaping, claw-like valves.

Description.—This is often a crooked tree, often with a stout trunk, with smooth white or nearly white bark sometimes with grey patches and usually with some grey flaky bark towards the ground. The leaves droop from the fine, drooping twigs; they are long, narrow and mostly curved, mostly at least 3 in. long and at least 8 times longer than



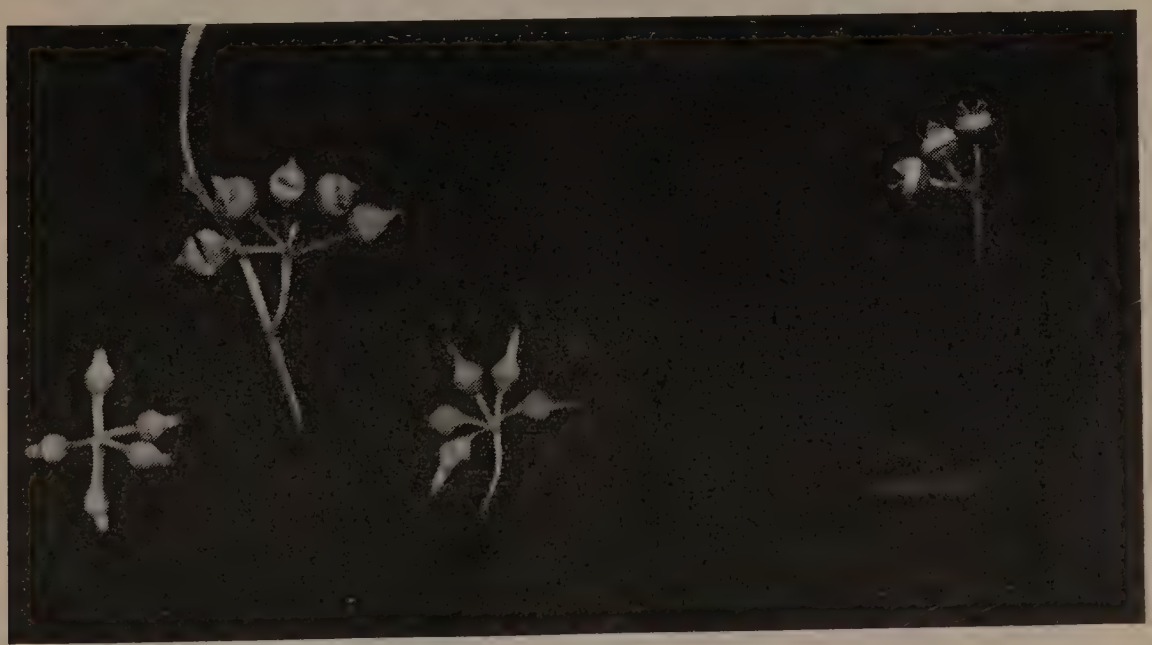


Plate 48.

River Red Gum (Eucalyptus camaldulensis). Branch, leaves, buds, flowers and seed-capsules.

wide. The flowers are produced in stalked bunches amongst the leaves and are ½ in. wide when fully out, each on its own slender stalk. The buds are rounded with a distinct point that is often quite long and the greater part is taken up by the lid. The seed-capsule is roughly rounded in outline, about ¼ in. long and wide, composed of three parts—a shallowly cup-shaped basal part, a middle part sloping inwards, and usually four stout, somewhat triangular, incurving valves.

Distribution.—Along the banks of the Condamine and Macintyre Rivers and some of their tributaries. One of the most widely distributed of all eucalypts, but chiefly an inland species except in Victoria and South Australia.

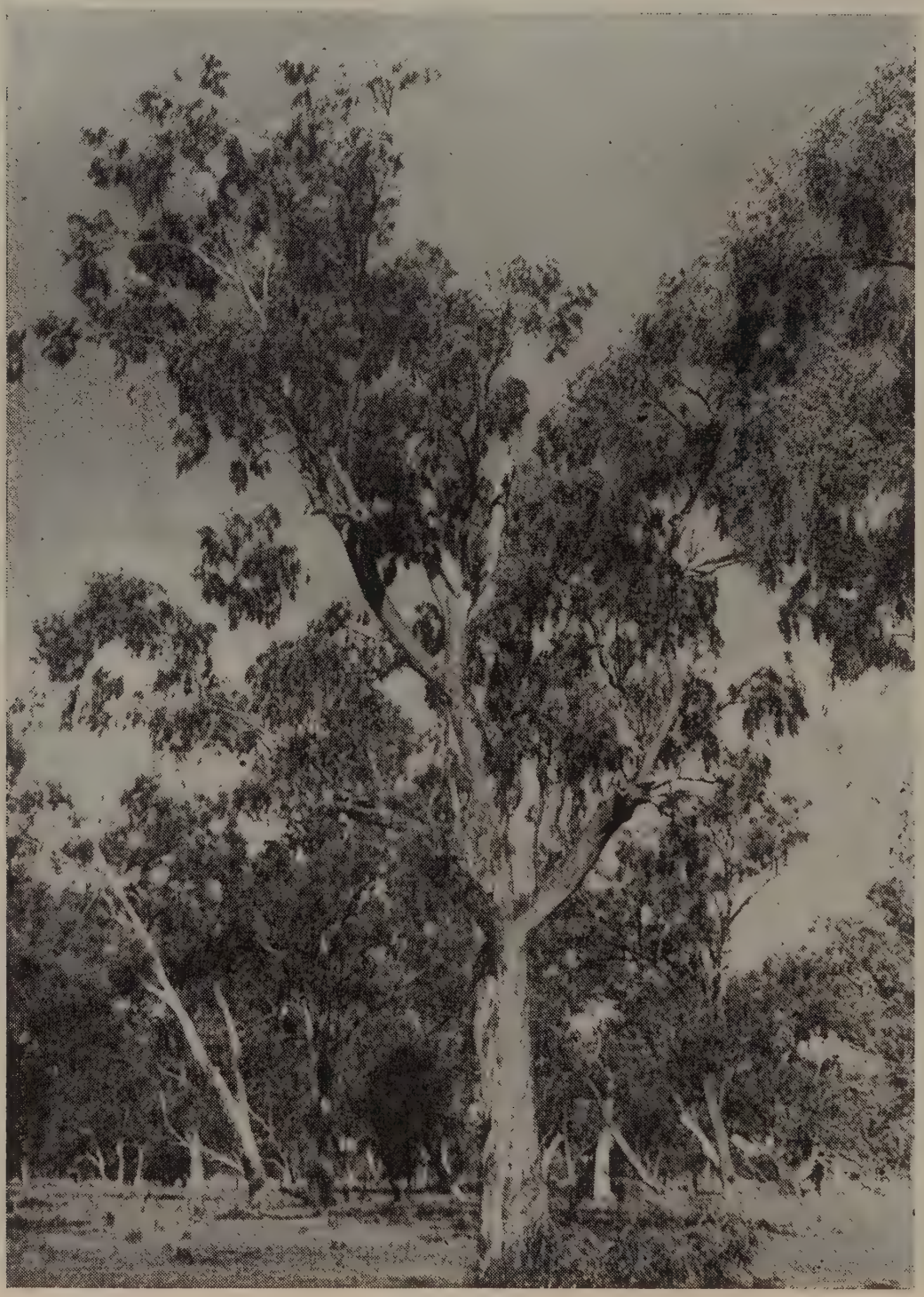


Plate 49.

River Red Gum (Eucalyptus camaldulensis). Texas.

Note. Blue gum and river red gum are not always easy to distinguish. They can usually be differentiated by the shape of the buds and less easily by the shape of the seed-capsules, but there are other species in the Darling Downs District resembling one or the other. *Eucalyptus acuminata* Hook. is one of these, having seed-capsules resembling those of river red gum and buds more like those of blue gum, but the lid tapers gradually to a point and is not curved; trees of this species have been found on creek banks and sandy hillsides.

Usual Flowering Time.—November-January.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Major.

General Remarks.—Every second year this gum usually blossoms heavily for a short period, resulting in a quick intense honey flow. For a few years it may flower annually, when nectar secretion will be poor. In a good season up to 120 lb. of this honey, together with large quantities of pollen, may be obtained by each colony. The pollen not only assists current broodrearing but the excess supply is stored by the bees for use in a time of scarcity, which often occurs in the early months of the year. During the flowering period of the river red gum ideal conditions prevail for queen-rearing, and at this time commercial beekeepers requeen as many colonies as practicable.

The tree flowers often in association with poplar box and the addition of the lighter coloured honey results in a blend which is classified as first grade.

River red gum honey is dense, with a pleasant mild woody flavour, and it granulates fairly slowly with a large brown-coloured grain. At times, it has a tendency to froth when being extracted.

The honey and pollen producing characteristics of the closely related gum, *Eucalyptus acuminata,* are practically identical with those of *Eucalyptus camaldulensis.* In districts where the two species are present, a variable proportion of what is known as river red gum honey and pollen is derived from the former tree, the amount depending on the relative distribution of the two species.

Fuzzy Box.

Botanical Names.—*Eucalyptus conica* Deane & Maiden, also known as *Eucalyptus baueriana* Schau. var. *conica* (Deane & Maiden) Maiden.

Other Common Names.—Apple box, grey box, blue box.

Distinguishing Features.—This is a narrow-leaved box (Plates 50-51) with the smaller branches smooth and small conical seed-capsules.

Description.—A tree mostly 30-50 ft. high with grey "box" bark on the trunk and large branches, and smooth whitish bark on the smaller branches. The twigs are reddish and commonly droop. The leaves are green with long stalks, narrow (4 or more times as long as wide), $2\frac{1}{2}$-$4\frac{1}{2}$ in. long, tapering and often slightly curved. The flowers are produced in bunches at and near the ends of the twigs and are about $\frac{1}{4}$ in. wide

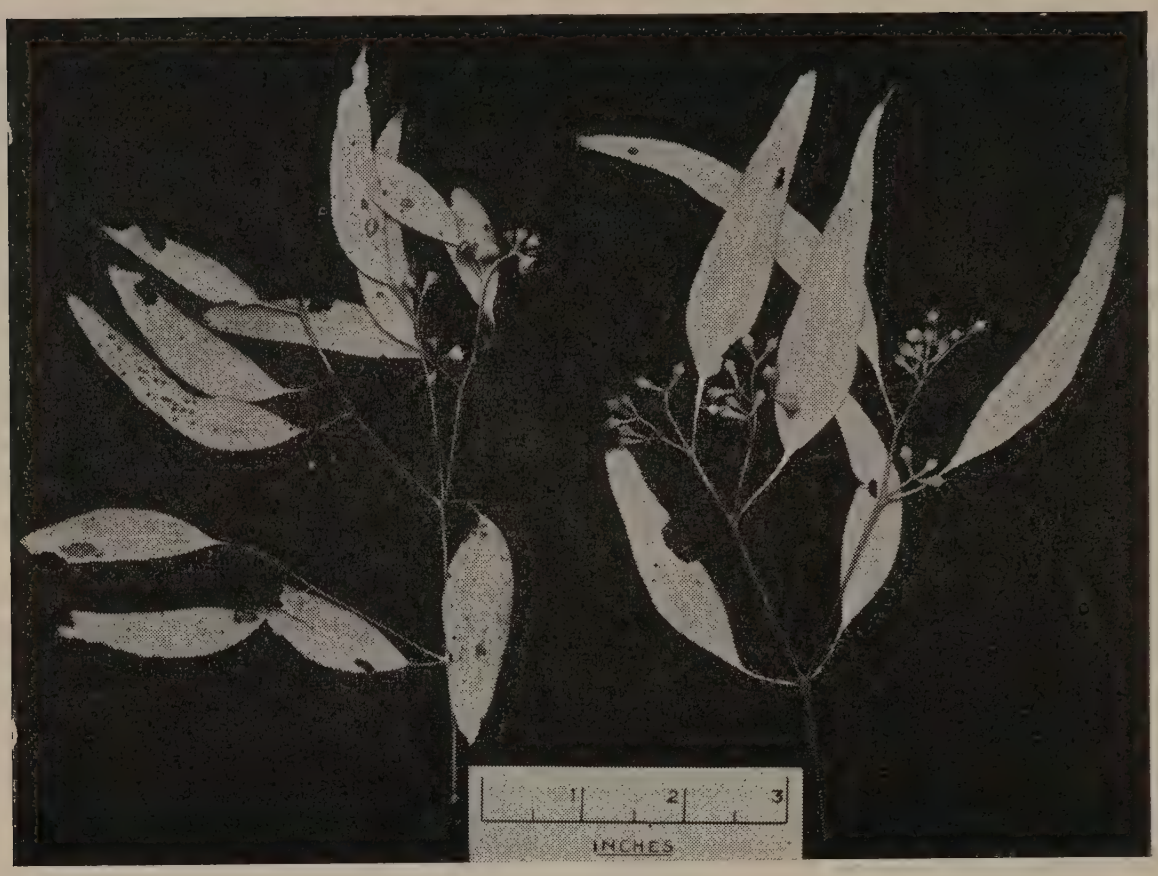


Plate 50.

Fuzzy Box (Eucalyptus conica). Leaves, seed-capsules and flower-buds.



Plate 51.

Fuzzy Box (Eucalyptus conica). Graysholm.

when fully out. The buds are nearly diamond-shaped, tapering to their stalks, and with a conical or shortly pointed lid shorter and narrower than the rest of the bud. The seed-capsules are almost conical in shape, with the wide end at the top, about $\frac{1}{5}$ in. long and slightly narrower.

Distribution.—Forest country in the southern and eastern part of the Darling Downs District, southern part of the Burnett District and the north-western part of the Moreton District. Also in northern New South Wales.

Usual Flowering Time.—August-October.

Colour of Honey.—Light amber with noticeable bright appearance.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Minor.

General Remarks.—About every second year fuzzy box flowers profusely in the early summer, when up to 60 lb. of honey may be harvested by each colony. It is often obtained as a natural blend with yellow box.

In the Texas and Stanthorpe areas, colonies build up on this species, although generally it is considered to be only a minor pollen plant.

The choice honey from this tree has a mild sweet flavour and good density. It is similar to other summer-produced "box" honeys in that it does not granulate readily.

[TO BE CONTINUED.]

INOCULATION OF LEGUME SEEDS.

★ ★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS.

(AS AT 15th SEPTEMBER, 1953.)

Breed.	Owner's Name and Address.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H.M. State Farm, " Palen " Stud, Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
	L. Puschmann, " Tayfeld " Stud, Taylor
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
	W. F. Ruhle, " Felbar " Stud, Kalbar
	C. E. Edwards, " Spring Valley " Stud, Kingaroy
	G. J. McLennan, " Murcott " Stud, Willowvale
	H. M. Wyatte, " Cumberland " Stud, Rocky Creek, Yarraman
	C. F. W. and B. A. Shellback, " Redvilla " Stud, Kingaroy
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla

TESTED HERDS—continued.

Breed.	Owner's Name and Address.
Large White	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
	R. S. Powell, " Kybong " Stud, Kybong, *via* Gympie
	E. B. Horne, " Kalringal," Wooroolin
	S. T. Fowler, " Kenstan " Stud, Pittsworth
	H. L. Larsen, " Oakway," Kingaroy
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	E. G. Evans, " Lauraven " Stud, Box 22, Maleny
	Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
	N. E. Meyers, Halpine Plantation, Kallangur
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
	G. I. Skyring, " Bellwood " Stud, *via* Pomona
	O. H. Horton, " Manneum Brae " Stud, Manneum, Kingaroy
	M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands
	N. R. Potter, " Actonvale " Stud, Wellcamp
	D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
	A. C. Fletcher, " Myola " Stud, Jimbour
	Salvation Army Home for Boys, " Canaan " Stud, Riverview
	F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
	A. J. Surman, " Namrus " Stud, Noble road, Goodna
	Department of Agriculture and Stock, Regional Experiment Station, Kairi
	E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
	T. A. Stephen, " Withcott," Helidon
	W. F. Kajewski, " Glenroy " Stud, Glencoe
	A. A. Herbst, Bahr Scrub, *via* Beenleigh
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	H.M. State Farm, Numinbah
	D. B. Alexander, " Debreczen " Stud, Kinleymore, *via* Murgon
	Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
	M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	H. Thomas, " Eurara " Stud, Beaudesert
	D. T. Law, " Rossvill " Stud, Trout road, Aspley
	J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
	A. Curd, " Kilrock " Stud, Box 35, Jandowae
	C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
	R. A. Collings, " Rutholme " Stud, Waterford
	M. Nielsen, " Cressbrook " Stud, Goomburra
	G. J. Cooper, " Cedar Glen " Stud, Yarraman
	M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
	A. H. Groves, " Kinvara " Stud, Ingleside, West Burleigh



A Survey of Dairy Herd Wastage in Queensland for 1951-52.

C. H. CLARK and R. A. PAUL, Division of Dairying.

IN previous surveys of dairy herd wastage in Queensland that have been published in this journal, it was the practice to give wastage information for all animals in the herd, including bulls, heifers and calves.

Organisations in some other countries have presented wastage figures in that form, while in some other cases, including some of the Australian Departments, details of wastage of cows only have been published.

There is an increased interest in the wastage of milking and dry cows in Queensland, and this article has been designed to provide this information as well as information on calf wastage.

In this survey for 1951-52, the average figures for 1948-51 have been included for comparison. Drought conditions prevailed in many districts from May 1951 until February 1952, while the seasons 1948-51 were fairly uniform. Rainfall in all areas covered by the 1948-51 survey was above normal for most months of the three years, except in the latter part of 1948 and May and June 1591. The survey for 1951-52 indicates the degree of wastage during a drought, while the 1948-51 figures

TABLE 1.

Approximate Average Rainfall for the Years 1948–1952 in Districts included in the Survey.

Year.	North Coast (Barron).	South Coast (Port Curtis).	South Coast (Moreton).	Darling Downs (East).	Darling Downs (West).
	In.	In.	In.	In.	In.
1948	53	31	45	27	21
1949	76	43	51	31	20
1950	93	55	70	41	34
1951	38	24	37	26	15
1952	53	40	39	30	23
Average Annual Rainfall	66	37	46	26	21

indicate the degree of wastage during fairly uniform seasons. Figures supplied by the Meteorological Bureau, Brisbane (Table 1) show that rainfall in all areas covered by the survey (except Eastern Downs) was below normal for 1951.

Sources of Data.

The information used in compiling this survey was furnished by farmers in various parts of the State who were members of herd recording groups.

For 1951-52 (July 1, 1951–June 30, 1952) complete returns were received for 82 herds. During the year many herds were withdrawn from recording for short periods as a result of drought conditions, and a great deal of incomplete information was discarded.

Wastage of Cows.

The chief reasons for disposals of cows in Queensland, in order of importance, are:—

(1) Low production.

(2) Old age.

(3) Sales of surplus stock for dairy purposes.

(4) Failure to breed (that is, sterility due to various causes).

(5) Udder troubles (chiefly mastitis).

(6) Calving troubles.

The total wastage of cows included in this survey is set out in Table 2. Cows sold for dairy purposes constitute a large percentage of disposals, but as they are not lost to the industry they cannot be included in determining true wastage. Excluding cows sold for dairy purposes, the true wastage for the State for 1951-52 was 21·8 per cent. This means that the average cow has a productive life of approximately five years; or the average dairy cow completes barely five lactation periods if she calves regularly each year.

TABLE 2.

Cow Wastage in Herds according to District.

—	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Wastage including cows sold for dairy purposes	23·7 (22·1)	23·2 (27·5)	29·9 (41·4)	20·4 (18·0)	25·5 (19·8)	12·1 (22·7)
Wastage excluding cows sold for dairy purposes	21·8 (17·3)	19·7 (15·9)	21·5 (24·1)	20·4 (15·9)	23·6 (17·0)	12·1 (18·7)

The figures in brackets are for the 1948–51 survey.

Serious economic losses must result if cows have to be culled before reaching full production, as the economic cow is one which will produce large quantities of milk and butterfat annually and for a number of years. In information collected for this survey, the ages of animals were omitted in many cases, and therefore it was impossible to assess the average age of disposal or to analyse wastage according to age.

TABLE 3.

CAUSES OF COW WASTAGE SHOWN AS PERCENTAGES OF ALL COWS, 1951–52.

Cause.	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Low Production	7·6	9·4	2·8	7·4	8·2	4·9
Aged	3·4	5·2	6·9	3·7	3·2	1·6
Udder Troubles	0·8	1·3	0·7	1·9	0·7	0·5
Brucellosis	0·3	..	..	..	0·3	0·5
Sterility	1·2	1·3	..	0·7	1·5	..
Calving Troubles	0·7	..	0·7	1·1	0·7	0·9
Tuberculosis	0·6	..	..	..	0·8	..
Poisoning	0·4	0·4	0·7	0·7	0·3	0·5
Bloat	0·02	..	..	..	0·03	..
Tick Fever	0·05	..	1·4	..	..	..
Milk Fever	0·03	0·4	..	..	..	..
Accidents	1·2	0·4	0·7	0·4	1·4	0·5
Drought	2·4	..	0·7	3·3	2·9	..
Other Known Causes	0·7	..	..	0·4	1·0	0·2
Unknown Causes	2·5	1·3	6·9	0·7	2·6	2·6
Total Wastage	21·8	19·7	21·5	20·4	23·6	12·1

TABLE 4.

CAUSES OF WASTAGE OF COWS ONLY SHOWN AS PERCENTAGES OF TOTAL COW WASTAGE, EXCLUDING COWS SOLD FOR DAIRY PURPOSES, 1951–52.

Cause.	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Low Production	34·9	47·8	12·9	36·4	34·6	40·4
	(38·4)	(34·7)	(16·7)	(42·1)	(41·2)	(30·4)
Aged	15·3	26·1	32·3	18·2	13·8	13·5
	(21·1)	(20·1)	(53·5)	(17·8)	(17·2)	(23·0)
Udder Troubles	3·6	6·5	3·2	9·1	2·9	3·8
	(9·9)	(6·7)	(4·4)	(11·3)	(11·0)	(16·9)
Brucellosis	1·3	—	—	—	1·3	3·8
	(0·9)	(—)	(2·6)	(2·0)	(0·5)	(—)
Sterility	5·5	6·5	—	3·6	6·3	—
	(5·5)	(10·5)	(1·8)	(4·6)	(5·3)	(4·7)
Calving Troubles	3·2	—	3·2	5·5	2·9	7·7
	(3·6)	(2·9)	(1·8)	(6·3)	(2·0)	(6·1)
Tuberculosis	2·5	—	—	—	3·2	—
	(1·2)	(1·7)	(—)	(0·4)	(—)	(—)
Poisoning	1·8	2·2	3·2	3·6	1·5	3·8
	(1·7)	(2·9)	(0·2)	(1·1)	(2·3)	(0·7)
Bloat	0·1	—	—	—	0·2	—
	(0·8)	(—)	(0·2)	(0·4)	(0·3)	(2·7)
Tick Fever	0·2	—	6·5	—	—	—
	(—)	(—)	(—)	(—)	(—)	(—)
Milk Fever	0·1	2·2	—	—	—	—
	(0·2)	(—)	(0·2)	(0·2)	(—)	(1·4)
Accidents	5·3	2·2	3·2	1·8	6·0	3·8
	(5·8)	(5·4)	(2·6)	(4·6)	(8·2)	(4·1)
Drought	11·0	—	3·2	16·4	12·4	—
Other Known Causes	3·3	—	—	1·8	4·0	1·9
	(2·4)	(5·4)	(3·5)	(1·3)	(2·2)	(2·0)
Unknown Causes	11·6	6·5	32·3	3·6	11·0	21·2
	(8·3)	(8·4)	(10·5)	(8·0)	(9·8)	(7·4)

The figures in brackets are for the 1948–51 survey.

Tables 3 and 4 show the various causes of wastage. Table 3 shows the various causes of wastage as percentages of all cows, while Table 4 gives a clearer picture of the order of importance of the various causes of wastage and reveals that low production is the chief reason for culling. Herds surveyed have been recorded for production for various periods, and it is probable that herd recording is responsible for a heavier culling rate for low production than is evident in the majority of non-recording herds.

Udder troubles have shown a further decrease in some areas. The figures indicate that there has been lowered incidence in South-eastern Queensland and the Downs areas. Many farmers in these districts are supplying milk to cheese factories and for market milk purposes. During recent years, the frequent laboratory testing of samples of milk in connection with the Milk Quality Control Scheme has led to an intensive check of herds on milk-supply farms for the purpose of locating cows affected with mastitis. It appears that the lowered incidence of mastitis may be attributed to its early detection and the extensive use of antibiotics in treating the disease.

There has been an overall increase in sterility and brucellosis in 1951-52 compared with the average for 1948-51.

Drought was the direct cause of 11.0% of total wastage in 1951-52. In previous surveys (carried out from 1947 to 1951) losses due to drought were insignificant and were included in "Other Known Causes". It is possible that the economic loss due to drought could be considerable when calculated over a number of years.

Reference to Table 5 indicates that the average herd included in the survey is composed of 60% cows, 2% bulls, 21% heifers (weaning to calving) and 17% calves (1 month to weaning). These figures show that the percentage of animals available for replacement is greater than the percentage of wastage in Table 2.

TABLE 5.

Composition of Herds.

—	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-eastern Queensland.	Downs.
Cows (Milking and Dry) ..	59·3 (61·1)	61·2 (60·8)	57·1 (53·1)	65·3 (65·6)	60·2 (61·9)	59·9 (51·6)
Bulls	2·2 (2·4)	2·3 (2·8)	2·1 (2·9)	2·8 (2·4)	2·2 (2·3)	1·8 (2·0)
Heifers (Weaning to Calving)	20·9 (20·6)	17·5 (21·1)	23·4 (24·1)	22·0 (20·0)	21·0 (19·8)	20·6 (23·6)
Calves (1 Month to Weaning)	17·7 (15·9)	19·0 (15·4)	17·3 (20·0)	9·9 (12·1)	16·6 (16·0)	26·7 (22·8)

The figures in brackets are for the 1948–51 survey.

Calf Wastage.

Tables 6 and 7 show the percentages of male and female calves born and the percentage of calves reared. The information given in the tables was prepared from particulars of calves born and disposal of calves not older than one month. Perusal of the tables indicates that there is a considerable variation in the number of calves reared in the various districts of the State.

TABLE 6.

Sex of Calves and Percentages of Calves Reared, 1951–52.

—	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Heifers Born	45·4 (45·6)	37·2 (45·1)	41·8 (47·3)	51·3 (46·4)	45·2 (44·7)	48·4 (45·2)
Bulls Born	54·6 (54·4)	62·8 (54·9)	58·2 (52·7)	48·7 (53·6)	54·8 (55·3)	51·6 (54·8)
Heifers Reared	67·5 (63·3)	55·0 (64·1)	88·2 (91·5)	38·1 (48·2)	67·1 (63·4)	87·2 (90·1)
Bulls Reared	10·9 (11·4)	1·5 (7·1)	6·6 (21·8)	7·1 (5·1)	5·2 (7·7)	55·0 (52·2)

The figures in brackets are for the 1948–51 survey.

TABLE 7.

Disposal of Calves not Reared shown as Percentages of all Calves Born.

—	All Queensland.	North Queensland.	Upper and Central Burnett.	South Burnett.	South-Eastern Queensland.	Downs.
Sold	23·0 (31·6)	24·2 (33·5)	9·8 (28·0)	72·6 (61·1)	19·9 (13·5)	17·0 (10·6)
Slaughtered	38·4 (30·6)	50·7 (31·2)	45·1 (16·3)	1·1 (10·2)	45·3 (52·2)	9·4 (14·9)
Died	1·5 (2·2)	3·6 (2·1)	0·8 (1·0)	3·0 (2·6)	1·1 (1·4)	3·0 (4·6)
Stillborn	0·5 (0·5)	0·9 (0·4)	0·8 (—)	— (0·9)	0·5 (0·3)	— (0·6)
Killed by Dingoes	0·03 (0·07)	— (—)	— (—)	0·4 (0·07)	— (0·03)	— (—)

The figures in brackets are for the 1948–51 survey.

The average percentage of heifer calves reared for the State is 67.5, so ample calves are being reared for normal herd replacements.

Discussion.

Herd wastage surveys carried out since 1947-48 indicate the general order of importance of some of the main dairy cattle losses. The extent and nature of some causes of wastage in individual herds may be concealed when converting these into an average for various districts and for the State. A summarised account will tend to put less emphasis on extreme cases—on the one hand, herds in which mastitis accounts for a large percentage of wastage or where large percentages are found to be reactors to the tuberculin test; on the other hand, herds which are almost completely free of disease and show a small amount of wastage. It is desired to present a picture of average conditions.

The general position indicates that low production is still the chief item in the average farmer's culling programme. Disease accounts for a large percentage of wastage and every effort must be made to diagnose, treat or apply preventive measures to decrease the incidence as much as possible.

PUREBRED PRODUCTION RECORDING.

Murcott Clara 3rd had a butterfat production of 365 lb. and a test of 4·5% for 1951-52. The figures were given incorrectly as 199 and 4·0 on page 108 of the February issue of the Journal.

How Buyers of Agricultural Requirements may Submit Samples.

F. B. COLEMAN, Standards Officer, Standards Branch.

THE Agricultural Standards Act requires that seeds, fertilizers, lime, stock foods, veterinary medicines, growth regulating substances, marking preparations, testing reagents, and any other materials which may be included within the ambit of the Act, comply with the guarantee on the label and with any standards that may be prescribed.

A person shall not be bound to accept delivery on the sale of any agricultural requirement unless all of the provisions of the Act relating to such agricultural requirement and the sale thereof have been complied with in full.

In order that a check may be kept on quality, provision is made for inspectors to take official samples on the premises of the seller. When the goods have been delivered to the buyer, section 75 of the Act makes provision for the purchaser to obtain a sample and forward same to the Standards Officer for purposes of examination and report thereon. Such section reads as follows:—

(1) Any buyer of any agricultural requirement shall, subject to this section, be entitled to submit a sample of that agricultural requirement to the standards officer for analysis and to receive a report of the result of the analysis.

(2) Each and every buyer intending to submit a sample for analysis under this section shall, at any time within fourteen days after the delivery of such agricultural requirement to him or within fourteen days after receipt by him of the invoice therefor (whichever is the later period), give notice in writing either personally or by registered post to the seller or the seller's agent of his intention, and of the day (not being earlier than fourteen days from the date of the giving or posting of such notice) and time and place when and where such sample will be taken.

If the seller does not within fourteen days after the giving or posting of the notice, attend personally or by agent at the time and place appointed by the buyer for the purpose, the buyer may, at that time and place or at any later time and at any place, but not later than twenty-one days after the giving or posting of the notice, take, or obtain the services of an inspector to take a sample of such agricultural requirement in the presence of a witness.

(3) (*a*) The sample shall be a fair average sample of the agricultural requirement concerned and, if prescribed, of the quantity or weight and taken as prescribed.

(*b*) The buyer shall divide or have divided the sample so obtained into three approximately equal parts, and shall mark and seal or fasten up each such part in such a manner as its nature permits.

(*c*) The buyer shall write or print or have written or printed upon each package or on a label affixed to each package particulars as follows:—

(i) Name of the agricultural requirement;

(ii) Number of packages from which sample was taken;

(iii) Number of packages received;

(iv) Markings, if any, on packages;

(v) Name and address of seller from whom the agricultural requirement was purchased;

(vi) Date agricultural requirement was received by the buyer;

(vii) Name and address of the buyer;

(viii) Date upon which the sample was taken.

Such particulars shall be signed by the buyer and the seller or agent (where the seller or agent is present) and witness.

(*d*) The buyer shall deliver or cause to be delivered one of such parts to the seller or his agent and shall deliver or cause to be delivered to the standards officer one of such parts accompanied by—

(i) The label or labels attached to the agricultural requirement at the time of delivery if same is or are procurable;

(ii) The invoice covering the sale of the agricultural requirement in question received from the seller if same was received or is available;

(iii) A request in writing, signed by the buyer, for a report of the result of the analysis;

(iv) The prescribed fee, if any:

Provided that if a buyer who in good faith has submitted any such sample for analysis satisfies the standards officer that he has substantial ground for his action in so submitting such sample based upon his own experience of the agricultural requirement concerned, no charge shall be made for analysis.

(4) The costs of and incidental to the obtaining of any analysis under this section shall, subject to the provisions of paragraph (*d*) above, be paid in the first instance by the person requesting the analysis, but shall subsequently be dependent upon the results of the analysis, and if the agricultural requirement does not comply with the requirements of this Act, shall be recoverable from the seller of such agricultural requirement by such person as a simple contract debt or, in the case of a conviction, for an offence, shall be added to the penalty and be recoverable in the same manner as the penalty, and, upon recovery, be paid to such person.

However Section 75 (5) of the Act provides that, in the case of seeds for sowing purchased for a buyer's own use, a free testing service shall be available upon complying with the following:—

(5) Nothwithstanding anything contained in subsections two, three and four above, a buyer of seeds or any other prescribed agricultural requirement for his own use may submit free of charge to the standards officer a fair average sample of that agricultural requirement by complying only with the provisions of paragraphs (*a*) and (*c*) and subparagraph (iii) of paragraph (*d*) of subsection three set out above:

Provided that any sample submitted under this subsection and the result of the analysis of that sample shall not be the basis of a complaint for an offence against this Act.

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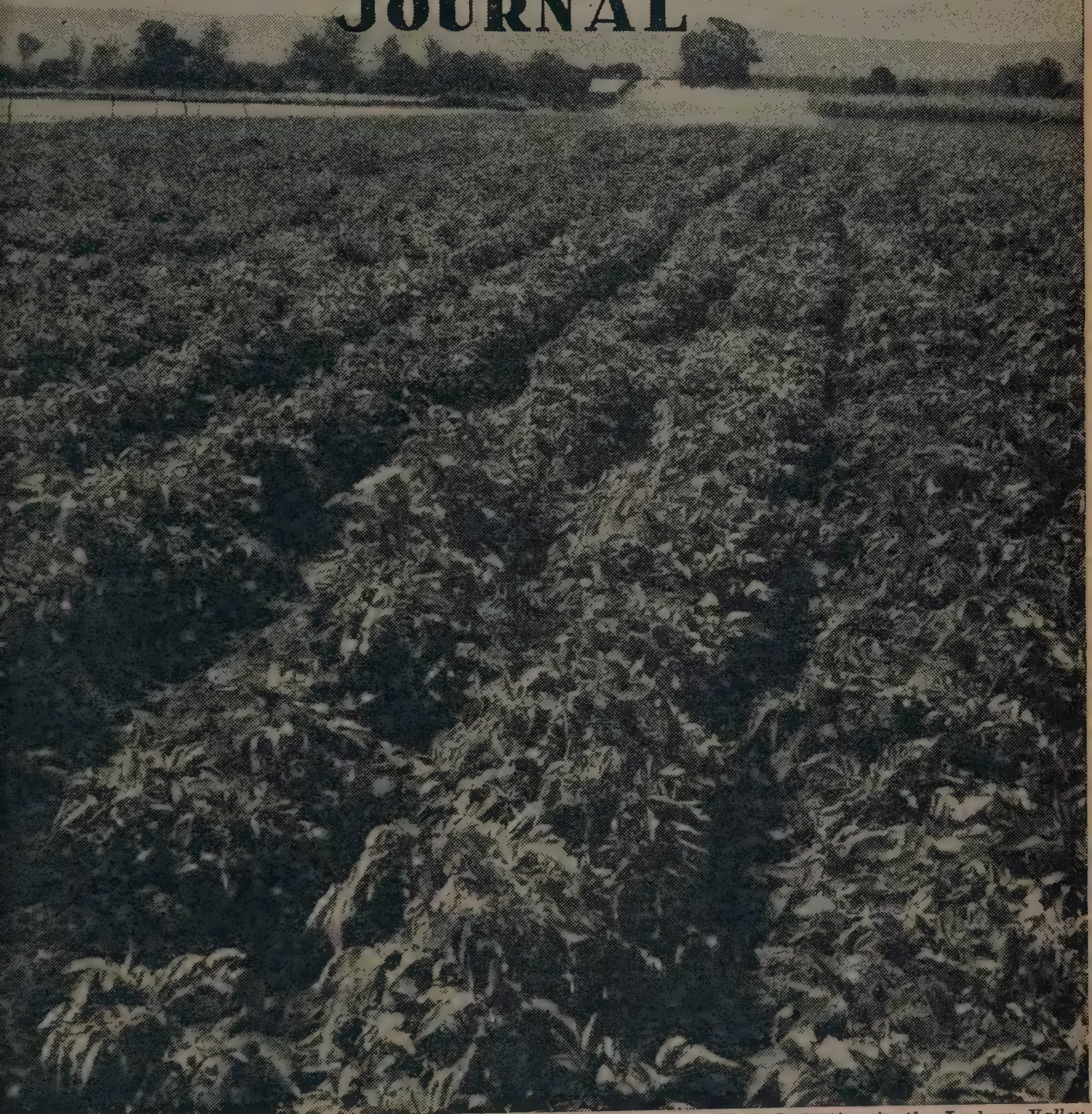
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Tuberculosis-Free Cattle Herds.

(As at 15th October, 1953.)

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus" Stud, Greenmount H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy Sullivan Bros. "Valera"' Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer" Stud, Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest" Stud, Wondai W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman W. H. Thompson, "Alfa Vale," Nanango S. R. Moore, Sunnyside, West Wooroolin H.M. State Farm, Numinbah D. G. Neale, "Groveley," M.S. 195, Pittsworth Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah W. D. Davis, "Wamba" Stud, Chinchilla
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount J. F. Lau, "Rosallen" Jersey Stud, Goombungee G. Harley, Hopewell, M.S. 189, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango F. W. Verrall, "Coleburn," Walloon C. Beckingham, Trouts road, Everton Park W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala G. H. Ralph, "Ryecombe," Ravensbourne Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah C. A. Edwards, "Grasmere" Jersey Stud, Woodford Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
Polled Hereford	W. Maller, "Boreview," Pickanjinnie J. H. Anderson, "Inverary," Yandilla



American Foul Brood of the Honeybee.

C. ROFF, Adviser in Apiculture.

AMERICAN foul brood is the most serious of the diseases affecting bees, and is responsible for losses in the beekeeping industry in many parts of the world. Economic management of bees is not possible in an infected apiary; however, the chances of serious losses are considerably reduced if beekeepers are familiar with the symptoms and with the correct procedure for dealing with an outbreak of the disease.

The causal organism of American foul brood is a bacterium* which, under suitable conditions, multiplies very rapidly. It is able to form resting bodies or spores which may remain viable and infective for long periods and are resistant to moderate heat and disinfection. The most common methods of spreading these spores are the utilisation of infected honey by nurse bees and the transfer of infected brood combs. The disease may also be transmitted by contaminated beekeeping equipment and the drifting of bees from diseased to healthy hives.

The Disease Position in Queensland.

Outbreaks of American foul brood during recent years at Pinkenba, Caloundra, Karara, Blair Athol and South Brisbane have given rise to anxiety in the beekeeping industry. The moving of apiaries from district to district has been practised extensively by beekeepers and has resulted in large crops of honey being harvested. Concurrent with the increase in migratory beekeeping, however, there has been a spread of American foul brood. A certain amount of migration will always be necessary, but it is desirable for beekeepers to adopt a thoughtful attitude in regard to the movement of apiaries in order to avoid consideration being given to restrictive disease control measures. Any such measures would undoubtedly limit the free moving of apiaries.

Routine Inspections.

It is sound beekeeping practice to *inspect regularly* the brood in every colony to ascertain whether American foul brood is present. *Furthermore, these inspections must be carried out thoroughly, and the work should be undertaken as a separate operation, and not in conjunction with other tasks.*

---

* *Bacillus larvae* White.

Features of the Disease.

(1) Larvae of all three castes are susceptible, and infection takes place only during the larval feeding period. Death occurs invariably after the capping of cells, when the insects are still in the late larval or early pupal stages.

(2) Larvae are susceptible to infection in all seasons, and an outbreak of the disease may appear irrespective of the quantity of food available.

(3) All races of honey bees are susceptible to American foul brood.

(4) Infected honey is not injurious to humans.

Symptoms.

(1) The colony is noticeably weak.

(2) The brood comb has an irregular appearance. In healthy brood the cappings are slightly convex, but where death has occurred they become concave or sunken and may be perforated. In addition, capped cells are somewhat scattered, giving what is often termed a pepper-box appearance (Plates 1 and 2).

(3) Diseased larvae or prepupae are at first slightly yellowish in colour, but as decomposition advances they gradually change to brown. The dead larvae are usually extended lengthwise in the cells.

(4) The decaying contents of a cell may, before drying, be drawn out with a wooden match or a splinter of wood into fine, glue-like, ropy threads. In drying, a tough dark-brown or coffee-coloured scale is formed which the bees cannot remove. This may be seen extended along the lower side walls when the comb is held so that sunlight falls on the side and lower walls of the cell.

(5) Where death has occurred after pupation a partly developed "tongue" may protrude as a fine thread upwards and backwards from the scale, sometimes adhering to the upper wall of the cell.

(6) The odour in an infected hive may become heavy and foetid, and has been likened to that of stale glue.

Preventive Measures.

The following measures for preventing the appearance and spread of American foul brood are recognised as sound:—

(1) The interchange of brood combs between hives and apiaries should be reduced to a minimum.

(2) Any manipulations or activities which induce robbing should be avoided.

(3) Second-hand bee equipment should be bought only after inspection has established freedom from disease.

(4) Honey from an unknown source should never be fed to bees.

(5) If second-hand honey tins are used great care should be exercised to ensure that the bees do not have access to them.

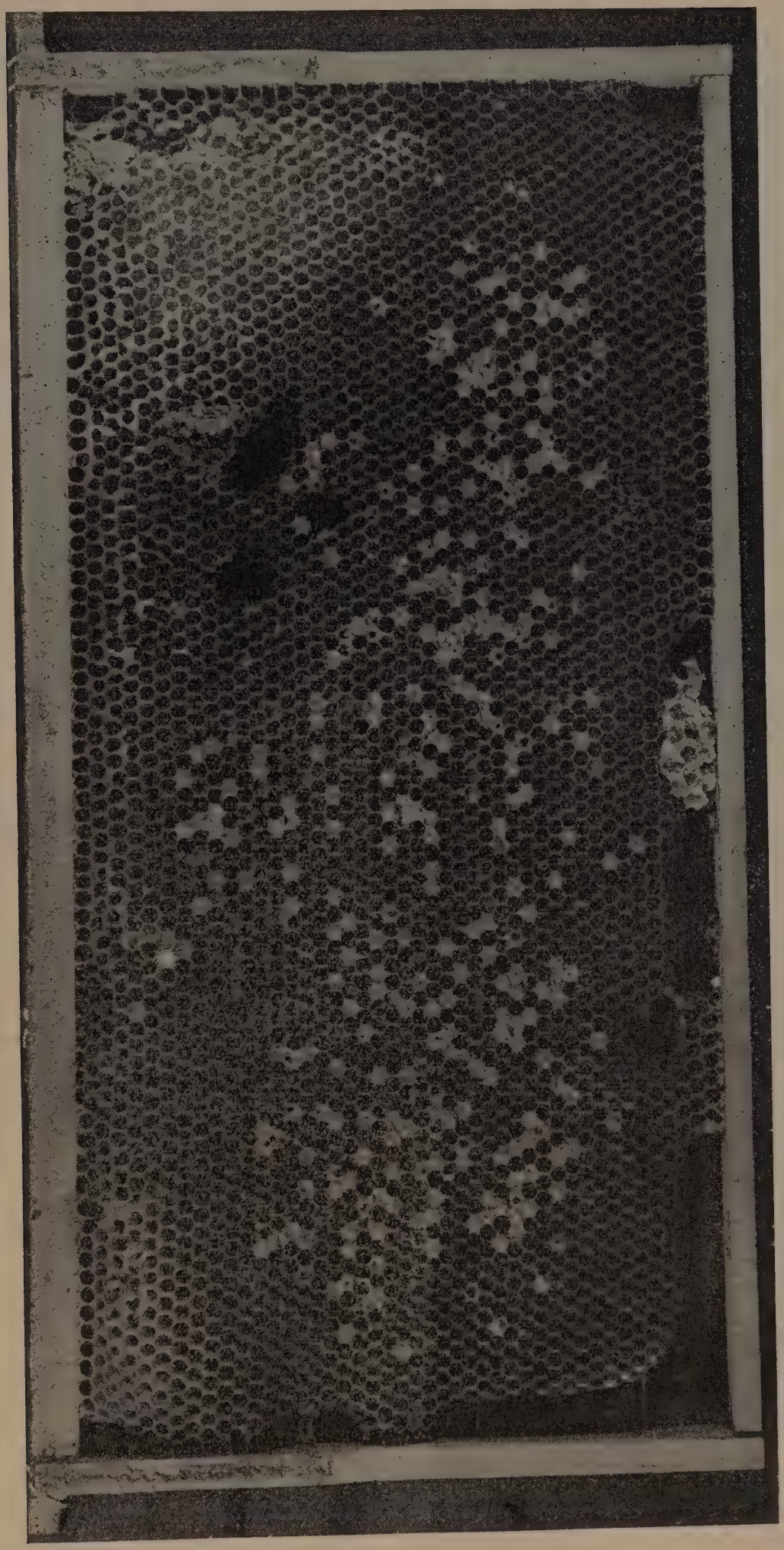


Plate 1.

Brood Comb Infected with American Foul Brood, Showing the Irregular Distribution of Capped Cells.

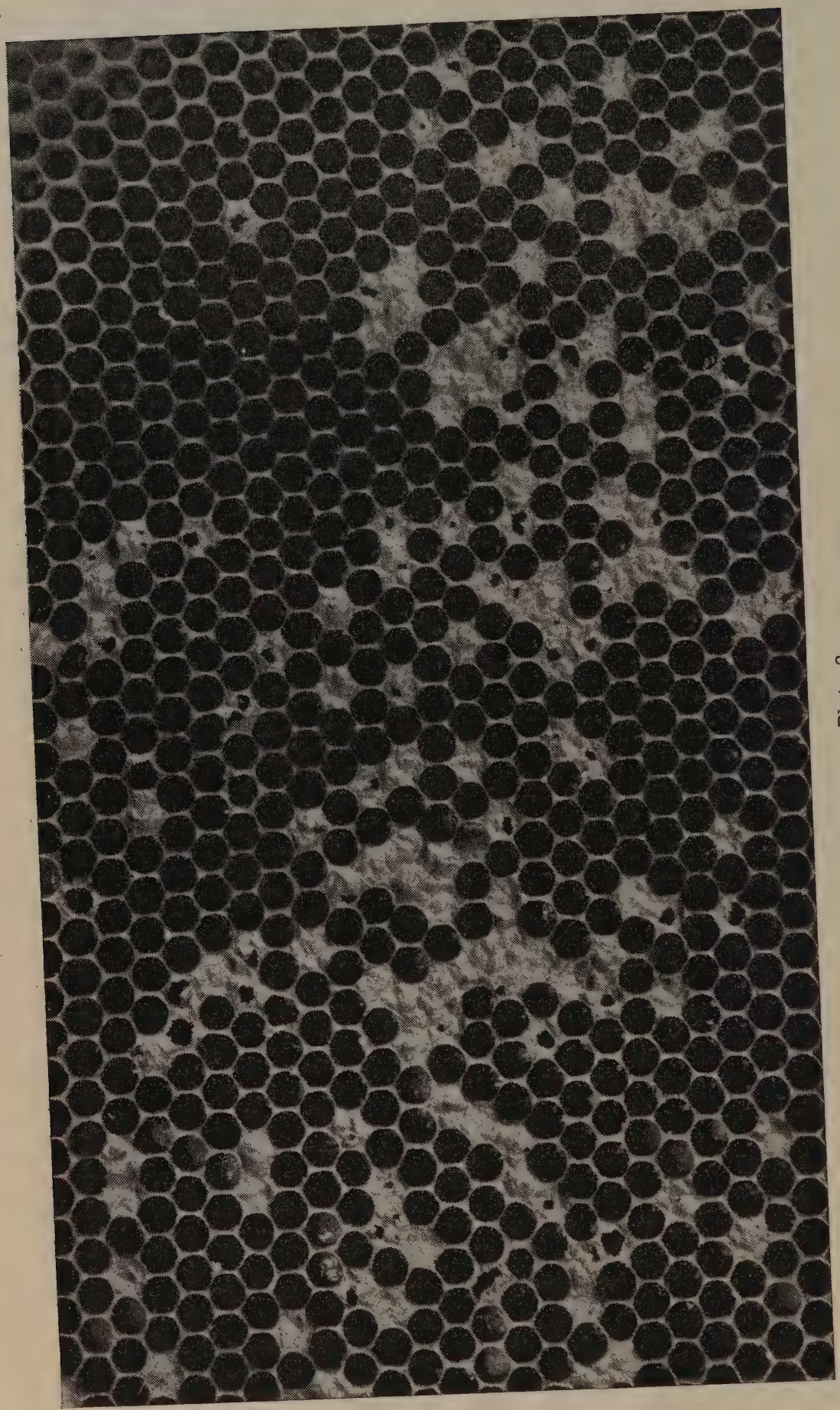


Plate 2.

Portion of Infected Brood Comb, Showing Sunken and Perforated Cappings.

Treatment of Infected Colonies.

All contents of diseased hives should be burnt and the hives themselves decontaminated according to the following method, which is the safest and most economical:—

(*a*) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(*b*) Dig a pit of a size suitable for the number of colonies to be destroyed.

(*c*) Kill all bees in the diseased hives with calcium cyanide; about two teaspoons of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken to avoid inhaling the poisonous gas given off by the cyanide.* If calcium cyanide is not readily available the hive entrance should be closed, a pint of petrol sprinkled over the top frames, and the top cover replaced.

(*d*) Build a fire in the pit, and as soon as it is burning well, add the dead bees and combs. The only parts of the hives not to be burnt are the bottom boards, the hive bodies of the brood nests, the bodies of the extracting supers, and the top covers.

(*e*) Remove all metal rabbets and then scrape the inside surfaces of the unburnt parts of the hives and burn the debris.

(*f*) After all diseased material has been burnt, spade the ground down, refill the pit, and pack well.

(*g*) Sterilize the undestroyed, contaminated hives and hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching all the inner surfaces and edges to a dark-brown colour with a blow torch.

Legislative Requirement.

Under "*The Apiaries Act of* 1947" it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual brood symptoms in his apiary should, for his own sake, communicate promptly with the Department in order that assistance may be rendered in treating the infection.

BEEKEEPING LEAFLETS.

The following publications are available free of charge to Queensland Beekeepers—

Beekeeping Legislation.
Hints on Making Hives.
European Foul Brood of Bees.
Nosema Disease of the Honeybee.
Pests of the Hive and Honeybee.

The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 239 of the October issue.*)

River Mangrove.

Botanical Name.—*Aegiceras corniculatum* (L.) Blanco; also known as *Aegiceras majus* Gaertn.

Other Common Name.—Small black mangrove.

Distinguishing Features.—A shrubby mangrove with green leaves not in pairs, and bunches of pure white flowers.

Description.—This is usually a bushy dark green shrub (Plates 52-53) up to 8 ft. high with leathery leaves singly arranged, tapering



Plate 52.

River Mangrove (Aegiceras corniculatum). Leaves, buds and flowers.

gradually to their stalks, rounded at the top, 2-3 in. long, about twice as long as wide, and often covered with a film of salt. The flowers are in bunches at and near the ends of the twigs. They are pure white, nearly $\frac{1}{2}$ in. wide, and the five petals are united into a tube. The five stamens are inconspicuous. The fruit is curved, narrow and pointed.

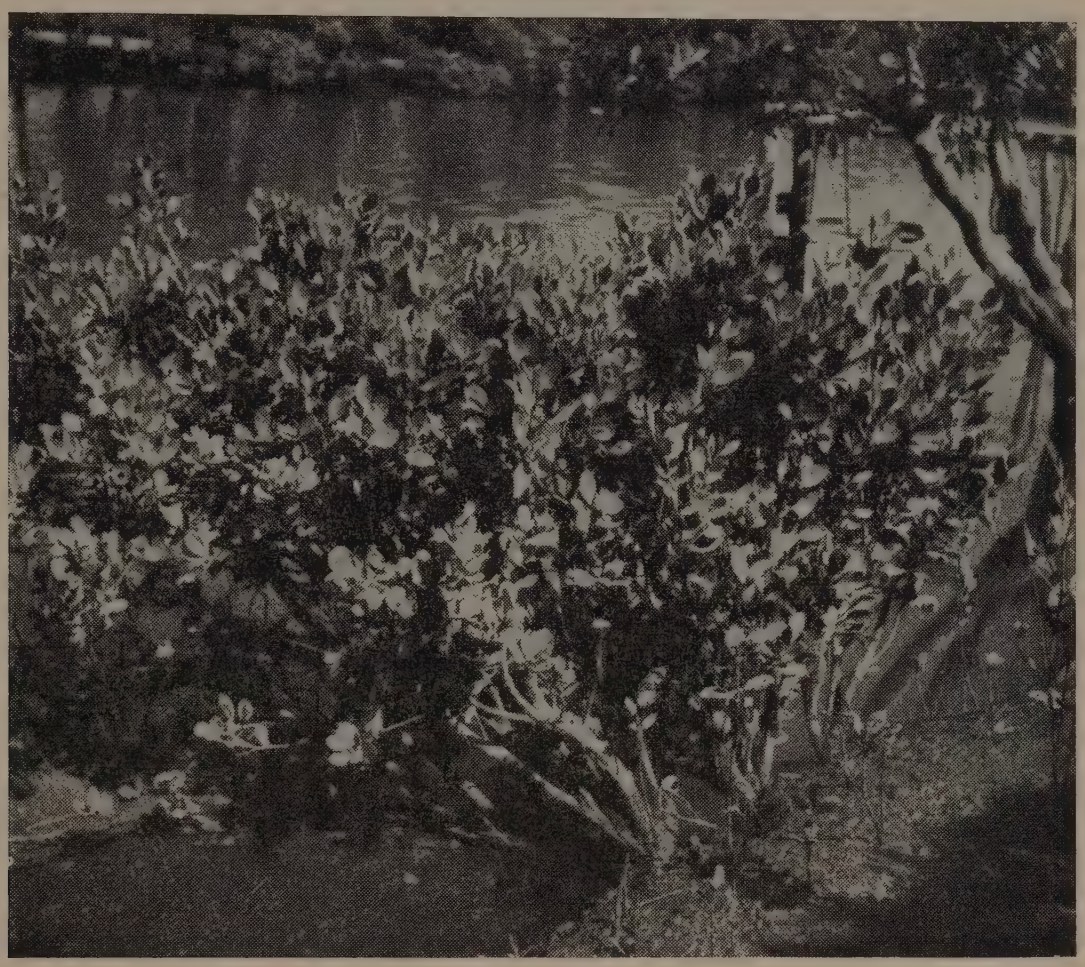


Plate 53.

River Mangrove (Aegiceras corniculatum). Bulimba Creek, Hemmant.

Distribution.—River mangrove is common on the landward side of the mangroves and extends up the rivers nearly to the tidal limit. It usually grows with the grey mangrove on river banks. It is common along the coast of Queensland, in Northern Australia and in countries north of Australia.

Usual Flowering Time.—October-November.

Colour of Honey.—Bright water-white.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Major.

General Remarks.—This species is the most valuable of the mangrove group. Some flowering occurs yearly, but usually a heavy honey crop is harvested in alternate years. Along the Mary and Susan Rivers, in the Maryborough district, this tree is used extensively by commercial beekeepers and it is not unusual for them to obtain up to 120 lb. of river mangrove honey from each colony. Elsewhere the amount harvested is considerably less.

Flowering of river mangrove may last for some eight weeks. Colonies thrive on this tree, working it freely for nectar and large quantities of greyish coloured pollen.

The honey has excellent colour, inferior density and a distinctive but not unpleasant flavour. During cool weather it granulates quickly.



Plate 54.

Grey Mangrove (Avicennia marina var. resinifera). Leaves and fruits, one with a germinating seed.

Grey Mangrove.

Botanical Name.—*Avicennia marina* (Forsk.) Vierh. var. *resinifera* (Forst.) Bakh.; also known as *Avicennia officinalis* L.

Other Common Name.—White mangrove.

Distinguishing Features.—A mangrove (Plates 54-55) with erect, peg-like branches of the roots projecting above the surface of the mud, and leaves in pairs, whitish underneath.

Description.—This is a tree up to about 40 ft. high but often much smaller, with light-grey, nearly smooth bark; peg-like projections from the roots grow for a few inches above the surface of the mud in which the tree grows. The leaves are arranged in pairs; they are grey-green above and whitish underneath, narrowed to each end, about 2-3 in. long and about 3-4 times as long as wide. The deep yellow or orange flowers are produced in small dense bunches at the ends of the twigs; they are scarcely more than $\frac{1}{8}$ in. long and wide, with 4 petals united into a tube in the lower part, but this tube is hidden by the five sepals. Four small stamens are attached to the tube. The fruit is four-lobed. The seeds usually germinate before falling, as in most other mangroves.



Plate 55.

Grey Mangrove (Avicennia marina var. resinifera). Bell Creek, Caloundra.

Distribution.—Along the coast in muddy estuaries and quiet backwaters, sometimes forming extensive stands, and along the banks of tidal streams. It or a closely similar species is found along the coast of eastern and northern Australia and in many other parts of the world.

Usual Flowering Time.—February.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor, occasionally medium.

Importance as Source of Pollen.—Medium, occasionally major.

General Remarks.—This tree produces both nectar and pollen. It is not, however, a prolific source of honey, as even during a good season a colony obtains no more than 40 lb. of predominantly grey mangrove honey.

The honey has a strong flavour, possesses weak density, and does not granulate readily. It adversely affects the grade of any other honeys in which it is blended naturally.

Notwithstanding its poor commercial qualities, the honey is excellent bee food, and this, with the moderate amount of pollen produced, makes grey mangrove a useful supporting species.

[TO BE CONTINUED.]

Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as " brucellosis tested " is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list ; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

TESTED HERDS (As at 15th October, 1953).

Berkshire.

J. J. Bailey, " Lucydale " Stud, East Greenmount
S. Cochrane, " Stanroy " Stud, Felton
G. Handley, " Handleigh " Stud, Murphy's Creek
J. L. Handley, " Meadow Vale " Stud, Lockyer
R. G. Koplick, " Melan Terez" Stud, Rochedale
O'Brien and Hickey, " Kildurham " Stud, Jandowae East
E. Pukallus, " Plainby " Stud, Crow's Nest
G. C. Traves, " Wynwood " Stud, Oakey
E. Tumbridge, " Bidwell " Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, " Palen " Stud, Palen Creek
A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
H. H. Sellars, " Tabooba " Stud, Beaudesert
F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
D. T. Law, " Rossvill " Stud, Trouts road, Aspley
R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, " Kenmore " Stud, Cambooya
H. L. Stark, " Florida," Kalbar
J. H. N. Stoodley, " Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, " Bardell," Goovigen
R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
L. Puschmann, " Tayfeld " Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, " Felbar " Stud, Kalbar
C. E. Edwards, " Spring Valley " Stud, Kingaroy
G. J. McLennan, " Murcott " Stud, Willowvale
H. M. Wyatte, " Deepwater " Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, " Redvilla " Stud, Kingaroy

Large White.

H. J. Franks and Sons, " Delvue " Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, " Highfields," Murgon
K. B. Jones, " Cefn " Stud, Pilton
R. G. Koplick " Melan Terez " Stud, Rochedale
R. Postle, " Yarralla " Stud, Pittsworth
E. J. Bell, " Dorne " Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, " Thistleton " Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, " Laurestonvale " Stud, Murgon
V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
R. S. Powell, " Kybong " Stud, Kybong, *via* Gympie
E. B. Horne, " Kalringal," Wooroolin
S. T. Fowler, " Kenstan " Stud, Pittsworth
H. L. Larsen, " Oakway," Kingaroy
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
E. G. Evans, " Lauraven " Stud, Box 22, Maleny
Mrs. I. G. Utting, " White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, " Bellwood " Stud, *via* Pomona
O. H. Horton, " Manneum Brae " Stud, Manneum, Kingaroy
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.

Tamworth.

S. Kanowski, " Miecho " Stud, Pinelands
N. R. Potter, " Actonvale " Stud, Wellcamp
D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
A. C. Fletcher, " Myola " Stud, Jimbour
Salvation Army Home for Boys, " Canaan " Stud, Riverview
F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert
A. J. Surman, " Namrus " Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
T. A. Stephen, " Withcott," Helidon
W. F. Kajewski, " Glenroy " Stud, Glencoe
A. A. Herbst, " Hillbanside " Stud, Bahr Scrub, *via* Beenleigh
R. G. Koplick, " Melan Terez " Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, " Debreczen " Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley

Wessex Saddleback.

W. S. Douglas, " Greylight " Stud, Goombungee
D. Kay and P. Hunting, " Kazan " Stud, Goodna
J. Gleeson, " Iona Vale " Stud, Kuraby
C. R. Smith, " Belton Park " Stud, Nara
H. H. Sellars, " Tabooba " Stud, Beaudesert
H. Thomas, " Eurara " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trout road, Aspley
J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
A. Curd, " Kilrock " Stud, Box 35, Jandowae
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, " Rutholme " Stud, Waterford
M. Nielsen, " Cressbrook " Stud, Goomburra
G. J. Cooper, " Cedar Glen " Stud, Yarraman
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
A. H. Groves, " Kinvara " Stud, Ingleside, West Burleigh



The Banana.

J. McGREGOR WILLS (Senior Adviser in Horticulture) and F. W. BERRILL (Assistant Horticulturist), Horticulture Branch.

(*Continued from page 210 of the October issue.*)

PLANTING MATERIAL.

THE type of planting material used has a considerable bearing on the success or failure of the plantation. It is essential that all planting material be obtained from reasonably mature, vigorous plants in an area which is free from the more important diseases and pests. Wherever possible, growers use their own planting material because better selection is possible under these conditions.

Three types of planting material (Plate 10) may be used—namely, butts, suckers and bits—but in actual practice the butts are of minor importance.

Butts.

A butt is obtained by removing the corm together with a portion of the pseudostem from a plant that has recently had a matured bunch cut from it, or, if the plantation is scheduled for eradication, is carrying a bunch or is just about to produce one. The pseudostem is severed so as to leave about 4 in. above the corm and the corm itself is trimmed. All eyes or buds except one are gouged out and the butt is then planted so that the junction of the corm and pseudostem is about 6 in. below ground level. A butt has a fairly large reserve of food material and butt plantings are therefore fairly resistant to adverse weather conditions which may occur at or immediately following the establishment of a plantation. A butt may be 10 lb. or more in weight; on hilly country where bananas are usually grown in southern Queensland, this presents an appreciable transport problem and planting of butts is now seldom practised.

Suckers.

Suckers are offshoots from the parent plant. They make excellent planting material provided they are sturdy, of the current season's growth and retain the narrow "sword" leaves until they are at least 18 in. high. The persistence of the sword leaves is an indication of plant vigour. Suckers about 2 ft. high with a corm not less than 3 in. in diameter are preferred in practice. Small suckers with a spindly stem and broad flattened leaves lack vigour and should be discarded as unsuitable for planting.

Suckers are the most widely used planting material, chiefly because they are easily obtained. A draining spade or sharp crowbar is a suitable implement for the removal of suckers from the parent plant, but irrespective of what method is used, care should be taken to ensure that the small corm is not damaged in the process. Suckers are planted with the junction of the corm and pseudostem approximately 6 in. below ground level. They should be placed so that the part originally furthest from the parent plant faces in the direction desired for the following sucker.

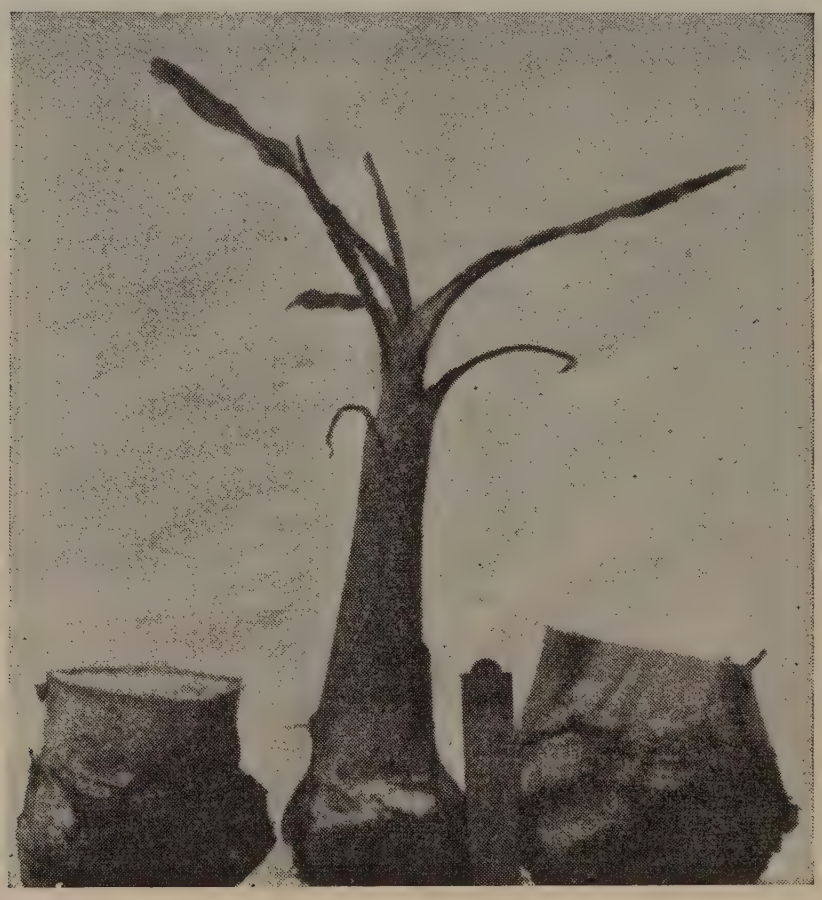


Plate 10.

Banana Planting Material. Left to right—bit, sucker, corm. Note position of bud (eye) on bit. Whole corms are seldom used.

Although a good plantation can be established from suckers, this type of planting material possesses an important defect. If conditions are fairly dry after planting, the sucker develops a new secondary corm on top of its original one. The new plant is then comparatively shallow-rooted and the old corm interferes with root development from the new corm above it. As the banana stool tends to work towards the surface of the soil with each successive generation of suckers, it is essential that planting material of this kind be set as deeply as is practicable.

Bits.

A "bit" is a portion of a corm carrying a mature bud or eye. Well-grown healthy plants at least six months old and preferably older, which have not yet bunched, provide good bits. The whole butt is dug out, the roots trimmed off and the outer tissue of the corm pared to a depth of about one-eighth of an inch as a precaution against weevel borer infestation. The pseudostem is usually removed about 4 in. above

the top of the corm. The corm may be cut into several sections in such a way that each bit measures not less than 3 in. in any direction and has one underground eye centrally placed.

However, there is a second series of buds near the upper surface of the corm and protected by the sheathing layers of the pseudostem. These upper buds are much younger than those below ground and tend to develop faster and produce more vigorous plants. For this reason, a bit cut so as to utilize one of these buds is generally preferred to a bit with an underground bud.

Only two bits, each with an outermost bud, should be cut from the one corm. The buds are located by carefully removing the outer ring of leaves to expose the pink edges of the next pair of leaves. One will be found at this point and the other is approximately opposite to it. The corm and attached pseudostem is then split in half so that each half possesses one of these two buds approximately centrally situated. The original growing point and any lower buds are gouged out, and the two bits are trimmed with square sides and base to facilitate handling and planting. Prepared bits may weigh 2-4 lb., but the larger that they can be cut the better. The upper buds are very susceptible to bruising and it is usual to leave a small flap of covering tissue as a protection during transport and planting.

Bits are considered the best type of planting material available owing to their normally rapid growth, the deep rooting system and the particularly even stand which develops from them. If soil moisture is very low at the time of planting, however, and irrigation is not possible, bits are usually affected more adversely than suckers planted under the same conditions. The bit should be planted in an almost vertical position with the eye facing usually in a south-easterly direction, and at a depth of about 6 in. below soil level. In heavy soils somewhat shallower planting may be preferable.

Planting material, whether suckers or bits, should be graded into at least two, and preferably three, groups for size and then allowed to stand for at least 24 hours before planting. During that period, the cut surfaces dry out sufficiently to prevent any subsequent breakdown. Each grade of bits or suckers can be planted as a block in the new plantation, in order to give reasonable uniformity to the stand and simplify cultural and harvesting operations.

PLANTING.

In a warm, moist, equable climate the banana may bunch in about 12 months, but the period varies from one district to another and even within any given district depending on the particular aspect of the plantation and the prevailing climatic conditions. For instance, in southern Queensland the rate of growth is relatively slow from April to September, and in a dry spring for an even longer period. Under these conditions bananas usually bunch 15-18 months after planting. Bunches thrown between January and March are usually cut when prices are high and for this reason growers endeavour to adjust their planting time so that the majority of the bunches in the plant crop will be thrown in this period. However, adverse climatic conditions may completely nullify even the most careful planning.

In southern Queensland, planting takes place from September to February, and usually late December or early January planting

produces the best results. The aim is to get the plants well established before the winter but not so far advanced that the development of the bunch has actually commenced. Thus, given ideal growing conditions and adequate nutrients in the soil, a December planted crop will have completed 3-4 months growth before the onset of winter. The initiation of the bunch commences immediately after winter when climatic conditions are favourable for the production of a large number of hands of good-sized fruit. As a general rule the taller varieties such as Lady Finger are planted somewhat earlier than Cavendish and Mons Mari, for they require a slightly longer period to reach an equivalent stage of maturity.

Under North Queensland conditions, growth is more or less continuous if soil moisture is adequate. Plant development is correspondingly more rapid and planting times must be amended accordingly.

Planting Methods.

Before marking out the plant positions, provision must be made for access roads and the removal of the fruit from the plantation. If the area is steep and broken, a wiring system may be the most economical method of conveying the bunches rapidly to the packing shed with a minimum of handling and bruising. If this is the case, the positions selected for the loading platforms should be so situated that the distance which bunches have to be carried is reduced to a minimum and that, as far as possible, they can be carried downhill.

The planting positions in the area should be marked out with a long stick cut to the length of the required distance between plants. Planting distances vary somewhat with the variety, but those in general use in Queensland are:—

Spacing (Feet).	Plants per Acre.	Spacing (Feet).	Plants per Acre.
9 x 9	535	13 x 13	260
10 x 10	435	14 x 14	220
11 x 11	330	15 x 15	190
12 x 12	300	16 x 16	170

The above figures are applicable to the square system of planting. As a general rule, the number of plants required for a block planted on the contour will be slightly less.

In contour planting the procedure is to work systematically along the lines which have been run, using the measuring stick to determine the position of each hole relative to the next.

When square planting is to be practised, a reasonably straight line is run across one side of the area, and another on the opposite side as far as possible parallel to the first. Using the measuring stick, "sighter" stakes about 7 ft. long are put in at the required intervals along both these base lines. A hole is dug at the first stake position on the base line. The measuring stick is laid with its end in the centre of this hole and in a direct line with the first "sighter" stake at the other side of the block; the second hole is then dug at its other end. This procedure is repeated when the planter turns and comes back along the row defined by the second pair of stakes, and so on. If the area to be planted is too large for easy sighting from one base line to the other, intermediate stakes can be placed along each planting row at intervals of about five chains.

The planting holes should be dug with a sharp mattock carrying a strong, preferably reinforced, blade. The hole should be at least 18 in. square by 15 in. deep, although it need not necessarily be symmetrical. The larger the hole the better, as a greater quantity of well-broken-up soil can be filled in around the young plant. If a large stone or stump happens to occupy the planting position and it cannot be readily removed, the hole should be dug above the obstacle so that there will be no restriction on the growth of the uphill sucker which is desired for the ratoon crop.

On hillsides, suckers are planted with the cut surface facing downhill and bits with the eye facing uphill. By this means, the followers can be set on the uphill side of the parent where they penetrate deeply into the soil and give added firmness to the stool.

In digging holes for bananas, the earth should be drawn into a small mound on to the lower side. In planting, a small amount of surface soil is first broken into the hole from the upper side. The sucker or bit is then placed in position, and sufficient soil is dug from the top and side banks to cover the plant to a depth of about 4 in. This soil is tramped down firmly. A further layer of loose soil is then added so that a sucker finally has about 6 in. of soil above the junction of pseudostem and corm, and a bit has the eye buried at a similar depth. When the work is completed, the plant will be in a shallow basin of loose soil with a mound on the lower side.

The period which elapses between planting and the appearance of the first shoot above ground level depends largely on the temperature of the soil and its moisture content—the higher the temperature the more rapidly the bud or growing point develops.

FERTILIZING.

When large areas of virgin rain forest were available for bananas, fertilizers were seldom, if ever, used. Now the use of fertilizer is essential on most plantations to maintain a level of soil fertility at which profitable crops can be produced for a reasonably long period. The banana is a gross feeder and makes heavy demands on the available plant foods in the soil. Many different fertilizers have been used, but as a general rule, a mixture with an N–P–K formulation 8–10–8 or thereabouts is suitable for most of the soils in southern Queensland on which bananas are grown. The rate of application depends on the planting distance and the quality of the land, but is usually from 1 to 1½ tons per acre per year.

The first application is made immediately after planting, 1–1½ lb. of fertilizer being distributed over each stool site and lightly worked into the surface soil. A second application at the rate of 1½–2 lb. per plant is required two months later, and this should be repeated at the end of a further two months. In this way the young plant receives the whole of its fertilizer in three applications before it is four months old.

As a plant grows, the roots gradually move out further from the corm, until, in a fully grown plant, there are comparatively few feeding roots within two feet of the base. The second fertilizer application should therefore be broadcast in a uniform band 1½–2 ft. wide round the plant at a distance of about 1 ft. from its base. The third dressing is applied similarly in a slightly wider band and correspondingly further out from the base. The fertilizer is lightly chipped into the soil.

A similar fertilizing programme should be followed in the ratoon crop, the follower sucker being treated as though it were a new plant and the times of application determined accordingly, the first being made when the sucker is 12–18 in. high. In first and second ratoon crops, however, the fertilizer should be applied in a semi-circular band on the side of the stool where the sucker is situated. After the third and subsequent ratoons, the easiest method of fertilizing is probably to broadcast the mixture in a wide band between the rows.

In plantations on open forest or replant land, where the fertility level is frequently low and the plants sometimes lack vigour, or in cases where individual plants are backward and require forcing, an additional dressing of 2 oz. of sulphate of ammonia per stool may be used with beneficial results. These supplementary dressings to backward plants can, if necessary, be applied each month for up to three or four months; they do much to even out the period of bunching and bunch development in the plantation. Such treatments should not be made during very dry weather, as an accumulation of sulphate of ammonia at the base of a stool can result in serious damage to the plants under such conditions.

On the red volcanic soils which are extensively used for banana production, dressings of ground limestone or dolomite are often applied with good results at intervals of about three years. Such applications tend to improve the texture of the soil and assist in making available to the plants certain essential nutrients. Both ground limestone and dolomite may be broadcast at the rate of 1½–2 tons per acre in early spring. This period is particularly suitable if a cover crop is to be sown in October.

CULTIVATION AND WEED CONTROL.

Weeds are apt to be troublesome in plantations established on replant land and on virgin land where the burn has not been satisfactory. The weeds may develop rapidly and compete with the young bananas for soil moisture, sunlight and plant nutrients. Efficient control is therefore necessary from the outset. On most plantations, particularly those on steep slopes, weed control is done entirely by hand hoe; on lesser slopes or relatively flat land, horse-drawn or power implements can be used effectively, at least in the early life of the plantation. Cultivation must be shallow and care must be taken to avoid damage to the stool.

In any system of cultivation the need for conserving surface soil is a major consideration, even in hand operations such as chipping. Chippers should therefore work towards the plant and drag the soil up the slope rather than down the slope.

If the rainfall during summer is heavy, chipping is sometimes impracticable and ineffective. Weedicides may then be used to keep weed growth in check. Arsenic pentoxide and sodium arsenite are used extensively in Queensland for this purpose at appropriate strengths, which are specified by the manufacturers. Two applications at an interval of about one month should be sufficient to control weed growth in summer. The sprays are applied on a calm day with the nozzles close to the weeds at a rate of 20–40 gal. per acre. Care must be taken not to wet the stools, particularly while the suckers are comparatively small.

Hormone weedkillers such as 2,4-D should not be used for the control of weeds in banana plantations; they are highly injurious to banana plants and wind drift from any type of spray apparatus may cause considerable damage.

During the first year in the life of a plantation, weeds should not be allowed to get out of hand or to seed. If they are effectively controlled during this period, chipping costs will be considerably reduced later on. During the wet season, when competition for moisture is not a limiting factor to plant growth, the weeds may be brushed before they seed if chipping is impracticable and weedicides cannot be used effectively; the brushed weeds left on the surface of the soil act as a mulch and reduce erosion during heavy rains. Under normal conditions, one man should be able to keep five acres of bananas free from excessive weed growth from planting onwards.

COVER CROPPING.

Cover cropping has been practised in some banana plantations located in southern districts with a relatively heavy rainfall. Poona pea is the usual crop, but some of the newer cowpea strains such as Reeves Selection may be more satisfactory if previous plantings have suffered from wilt. In tropical areas, cowpeas are less satisfactory, as the plants tend to get out of control and climb over the stools. The green manure cover crop reduces the loss of surface soil from erosion. It also suppresses weed growth during the summer months, and little chipping or hoeing is necessary before April, by which time the cover crop has matured and died. In districts with a rainfall under 50 in. per annum, cover crops may compete with the bananas for available soil moisture during dry periods and the practice has, therefore, a local rather than a general application.

In a bearing plantation, the best results are obtained by growing the cover crop in a narrow band less than four feet wide across the slope between every alternate row of bananas. By adopting this method, it is a relatively simple matter to mow or chip these strips quickly in a dry period and so remove any competition for soil moisture which might otherwise seriously affect the bananas. If the seed is sown in moist soil at the rate of about 20 lb. per acre and either chipped in or buried by a rotary hoe operated with a shallow cut during late October, the legume can be established very quickly. In young plantations from which bunches will not be cut during the growing period of the cover crop, a strip may be sown between every row of stools.

During the period of most vigorous growth, usually late January and February, routine brushing may be necessary to keep the legume away from the stools. The amount of brushing required depends mainly on the variety of cowpea used, being relatively slight with Reeves Selection, Brabham, Victor or other strains with a semi-erect habit.

MULCHING.

Instead of cover cropping, the banana plantation may be mulched with various types of organic material. The use of a surface mulch has many advantages over clean cultivation. By shading the ground, it reduces the loss of water by evaporation and keeps the soil cool in summer. The mulch also assists in preventing soil erosion. Even in a heavy downpour, the raindrops cannot reach the soil directly and pulverising of the surface layer of soil by splashing and washing is

eliminated. Provided the mulch is spread evenly and sufficiently thickly, weed growth is almost completely suppressed and chipping no longer required.

Many different materials have been used for mulching in Queensland. Blady grass is probably the best, since it does not rot down quickly and is usually readily available in quantity close to most plantations (Plate 11).



Plate 11.

Bananas Planted on the Contour and Mulched, North Coast. This is the same plantation shown in Plate 8 six months later. Note the inter-row drain showing as a depression in the blady grass mulch cover.

In applying the blady grass the material should be spread as uniformly as possible over the whole of the plantation to a depth of approximately 6 in. but not closer than 3 ft. to the base of the stools. This bare area around each plant facilitates fertilizing the young plants and ensures that sucker development will be normal. Weeds in this unmulched area can be hand-pulled if necessary. As the lower layer of grass gradually rots down, additional light dressings of mulch can be applied to maintain the initial thickness. Blady grass from about three acres of land is required to mulch an acre of bananas.

All weed growth should be eliminated, either by chipping or spraying, before the mulch is put down, and if any perennial grasses such as common couch are present these should be carefully and completely eradicated.

CROP CONTROL.

The success or failure of a plantation as an economic venture depends very largely on the ability of the grower to control plant growth so that the bunches will be harvested when market prices are

most remunerative. The careful selection of site and aspect, the provision of windbreaks, contouring, and where practicable, irrigation, do much to eliminate climatic hazards in a banana plantation. Control of cropping is, however, equally important, for it determines both the period of harvesting and to a great extent the life of the plantation. Such control depends on the setting of the right type of sucker at the correct time of the year.

Selection of the Follower.

When the crop is grown without irrigation, it is usual to select only one follower from each parent plant for the ratoon crop. Under this method of management, commonly referred to as the "one-bunch-one-sucker" system, the number of bunches per acre is controlled in order to ensure that those which are produced will be large and the fruit of good quality. On very fertile soils, two suckers may be allowed to develop for the first ratoon crop, and under irrigation even a third may be permissible; but in either case only one sucker should be set on each plant in succeeding generations.



Plate 12.

First Ratoon Suckers. Suckers on these two Mons Mari plants were set at the correct time. Note the stages of development of parents and followers.

The sucker selected should be deep seated, and this is often indicated by the fact that it breaks through the soil well out from the base of the parent plant. However, deep suckers do sometimes break through the ground close to the parent plant, and shallow suckers may, if they strike

an obstacle, come up some distance away from it. It should be spear-shaped, with a well-developed corm and narrow sword-shaped leaves. Shallow-seated suckers lack vigour and rarely produce good plants. The extreme type, commonly called a "sitter", arises from a bud at or just below ground level and produces a corm more or less on the surface of the soil. Suckers of this type are of no value as followers, although they provide good planting material. A deep-seated sucker, on the other hand, will develop a substantial root system at the soil depth most suited to the plant.

On hillside country, the sucker for the first ratoon crop should be selected on the uphill side of the parent, preferably at an angle up and across the slope rather than directly behind the original plant. The rotting down of the butt of the parent plant after the fruit is harvested will not then weaken the following sucker, which still has soil to support it on the lower side. The sucker should always be selected towards the side of the parent where it will receive the greatest amount of sunlight; in most cases this will be the south-east.

The first follower should be set before the parent plant throws its bunch. Since location, soil type, aspect and altitude all influence the time taken for a plant to bunch, the time of setting of the follower will vary with the plantation. Generally speaking, however, the best month for planting should be the best month for sucker setting, but in some areas allowance has to be made for the fact that ratoon plants usually take a longer period to bunch than maiden plants. If the followers are all set at or about the same time, more uniform bunching for the next crop should be achieved.

The time of setting of the first follower to a large extent determines the success or otherwise of the plantation, for the behaviour of the crop in the third and subsequent years is governed by the management of the first ratoon (Plate 12). If two suckers are set for the first ratoon crop, each should be directed at an angle to the parent plant up and across the slope so that a large "V" is formed with the parent at the lower point.

The selection of suckers for the second and subsequent ratoons is based on what is commonly referred to as the "straight follow through" system. The "straight follow through" sucker arises more or less directly in line with the previous season's sucker and the original parent, and originates from a bud situated almost at the base of the corm. This fact ensures that it is firmly established in the soil and has a considerable rooting system (Plate 13).

Sometimes more than one sucker may break through the ground in a straight line with the pseudostems of the two previous generations. The first of these is usually fairly shallow and appears early in the life of the plant, whereas the required "straight follow through" sucker does not appear until the parent plant is about two-thirds to three-quarters grown. This generally coincides with the time when it is most desirable to set suckers for the next crop. Under normal conditions, therefore, the selection of suckers for the second and subsequent ratoon crops is to a very large extent automatic if the first follower has been set at the correct time.

Desuckering.

All sucker growth arising from the plant prior to or after the selection of the desired follower should be removed as soon as possible after its appearance. If allowed to remain on the parent plant, these

unwanted suckers reduce its vigour, delay cropping and adversely affect yield. During spring and summer, when sucker growth is rapid, it is necessary to desucker the plantation at least once a month; during autumn and winter, when growth is less vigorous, desuckering at intervals of two or three months is normally sufficient.



Plate 13.

Second Ratoon Suckers. Complete stool dug out to illustrate position of "straight-follow-through" sucker. A, maiden plant; B, first follower; C. "straight-follow-through" sucker. Note the point of origin of this sucker at D relative to the ground level at E.

Desuckering may be done with a special desuckering tool or gouge, made from a 3 ft. piece of spring steel $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. About 15 in. of one end is hammered out, and the edges turned up and sharpened. This

"blade" is tapered to a point of about ½ in. across. The top of the gouge is generally fitted with a handle of ½ in. round iron for better leverage.

Where the plants to be removed are more than 6 in. above the soil surface, they should be cut off with a knife at ground level and the centres bored out by inserting the gouge in a vertical position and giving one complete turn. In this way, the growing point of the sucker is removed and further growth suppressed without interfering with the rooting system of the stool. A few handfuls of soil placed in and over the inverted cone-shaped cavity of each sucker treated, immediately after the operation, will stop an excessive discharge of sap through the new wound.

Small suckers just showing through, commonly known as "peepers," may be gouged out in a similar manner, but in this case there is no necessity to cut the tops off first.

Within recent years the use of a gouge has been largely superseded by the kerosene method of desuckering. The latter is rapid, relatively simple and speeds up the rotting and decomposition of the butt of the sucker without interfering with the root system of the parent plant. The procedure is to cut the sucker off just above ground level with a sharp knife and then, using the point, gouge out a small central portion of the butt. About one-half of a teaspoonful of kerosene is poured into the cavity, the quantity being increased slightly if very large suckers are encountered. The kerosene can be handled most conveniently if it is carried in a bottle fitted with a cork through which a piece of glass or metal tubing projects. This ensures that the liquid is not splashed on the parent pseudostem or spilled.

TRASHING.

Trashing is the removal of dead leaves from the pseudostems of the plants. As the plant ages, the older leaves die and hang as a cloak of dead tissue which keeps the pseudostems cooler than would otherwise be the case and slows down the rate at which the plant and its associated suckers grow.

Trashing is usually carried out at the same time as desuckering by simply cutting the dead leaves off with a knife where they bend over and hang down from the pseudostem. Tearing off the leaves opens up the leaf bases and results in damage to the pseudostem by loss of water and chilling; the practice has nothing to commend it.

PROPPING.

During the wet season, when strong winds frequently accompany heavy rain, the root system of the banana is often incapable of supporting a plant carrying a heavy bunch, and unless the plant is propped, it may be blown over and the bunch lost. Dwarf Cavendish bananas require less propping than Mons Mari and Williams Hybrid, whilst Lady Fingers rarely need propping at all.

Props are best placed in position as soon as the last hand on the bunch has become visible. The safest type of support is a double prop, made from two pieces of timber of equal length fastened together by a bolt or piece of wire about a foot from the end (Plate 14). When the legs are spread the top forms a "V" in which the bunch stalk is held; this supports the bunch firmly, and, no matter how rough the weather, the prop cannot fall away and leave the bunch unsupported.

Another satisfactory type of prop may be made by boring a hole about 6 in. from the end of the timber and passing about 2 ft. of No. 8 or No. 10 gauge wire through it. The ends of the wire are bent upwards parallel to the prop so as to project beyond it, and the lower part of the wire is held in position with staples. When placed under the neck of the bunch, the wire forms a "U" and holds the bunch firmly.



Plate 14.

Propping the Bunch. Note the spread of the two legs to give stability with the bunch hanging clear and safeguarded against abrasion. The fork of the prop holds the bunch stalk, not the pseudostem.

Forked saplings may be used as single props, but they are difficult to obtain and rarely last more than one year. Pointed props stuck into the side of the pseudostem or the bunch stalk should not be used; they give little support, and during rough weather the movement of the plant either dislodges the prop or forces it deeply into the tissues. The bunch stalk may then eventually break and the bunch "snaps" off.

When placing the prop in position, care should be taken to ensure that the fruit on the side of the bunch next to the pseudostem is not scratched or bruised, and also that the legs are so placed that when fully developed the bunch will hang well clear of the prop even in windy weather.

The length of the prop will vary according to the variety of banana and the steepness of the country, but it should be such that the legs have a good spread and the prop stands at an angle under the bunch. If the props are too short and stand almost vertically, they have a tendency to lift the plants out of the ground, particularly during wet weather.

The bunch flower, commonly termed the "bell," should be cut off when the bunch is about half matured, as its retention only increases the weight which has to be supported and to some extent delays the maturity of the bunch.

BUNCH COVERS.

In southern Queensland, bunch covers can be used to advantage, particularly in plantations which are exposed or liable to premature defoliation following an outbreak of leaf spot. During the winter months, fruit blemishes are common and considerably reduce the value of even well-filled fruit. Bunches protected by suitable covers are invariably free from these blemishes and the fruit develops and matures more evenly than it would do otherwise. In practice, covers should be fitted not only to the bunches on partially defoliated plants but to all bunches which are likely to be harvested between May and September.

Chaff bags or corn sacks make suitable covers if the bottom of the sack is cut open, slipped up over the bunch and tied firmly around the stalk above the top hand. The other end of the bag is left open so that that fruit can be easily examined as the bunch approaches maturity. Heavy paper bags are specially manufactured for covering banana bunches and these may be used if desired. Unlike the hessian bags, they can usually be used for only one season and may prove unserviceable during very wet, cyclonic weather accompanied by high winds.

The use of bunch covers increases production costs in the plantation, but the additional capital outlay is amply repaid by the high quality of the fruit and the increased marketing returns.

HARVESTING.

Only fully-matured bunches of well-filled fruit should be harvested (Plate 15). However, bunches should not be left on the plant until the fruit begins to colour or the fingers are so full that they split when being packed.

A bunch is ready to cut when the fruit is evenly rounded without showing prominent ribs and the remains of the flowers break off readily from the tips when rubbed. Thin, angular, immature fruit should not be harvested under any circumstances. Experience is required to judge the stage of maturity at which fruit should be harvested in order to obtain top market prices.

For cutting bananas, a cane knife, reaping hook or large butcher's knife may be used. With the Cavendish variety the leaves are first cut away to give freedom of action, and the bunch stalk is then severed above the top hand by a downward stroke of the knife, leaving sufficient length for easy handling.

Mons Mari and the tall varieties require a different technique, the exact method depending on whether or not the plant has been propped. If it is propped, a "V" cut which is deep enough to sever the bunch stalk in the middle of the pseudostem should first be made on the side nearest the prop about 6 ft. from the ground. This allows the pseudostem to sag and the prop may be used to lower the bunch until it can be cut comfortably. If the plant has not been propped, a slanting cut is made half-way through the pseudostem at a suitable height. This allows the plant to sag sideways and the "tail" or flower end of the bunch may be caught and used to guide the bunch down until it can be cut easily. In either operation, two men should work together.



Plate 15.

Bunch Ready for Harvesting. The fruit has lost its former angular shape and the remains of the flowers are dead.

After cutting, the bunches are usually taken to every fourth row and placed on heaped leaves to reduce injury to the fruit. They are then carried to points from which they can be "wired" or otherwise carried to the packing shed. Wherever workable, wiring systems are to be preferred, as they permit rapid transport of the fruit from the field and cause less damage than other methods.

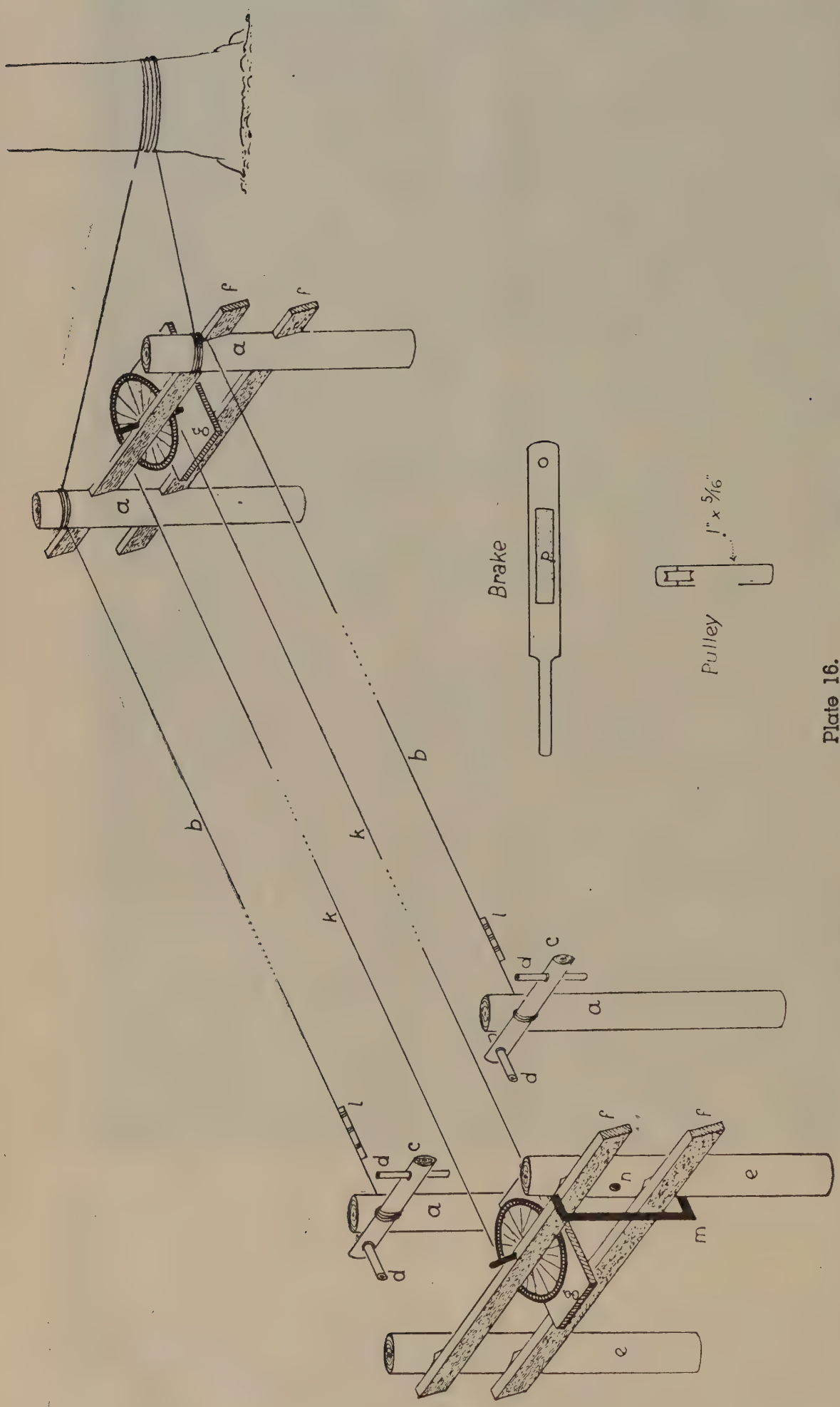


Plate 16.

Sketch Plan of an Endless Wiring System for Bananas. (a) main posts for carrier wires sunk 4 ft. in ground and stayed; (b) carrier wires along which the pulley runs with bunches to the packing shed and then back empty to loading ramp; (c) rollers for tightening carrier wires; (d) levers for operating rollers; (e) terminal posts; (f) cross bearers; (g) platform supporting guide wheels for endless wire; (k) endless wire with guide wheels at ends; (l) stop for pulley carrying bunch; (m) brake frame; (n) brake arm pivot. (Insets) brake arm, which operates on lower guide wheel for endless wire; pulley on which the bunch is hung (a detachable rope ties the pulley on the carrier wire to the endless wire).

WIRE TRANSPORT.

Various aerial wire systems are in use, ranging from a single wire stretched from a stump within the plantation to another stump near the packing shed, along which run loose pulleys bearing short rope slings by which the bunch is suspended, to elaborate installations. Probably the best from the point of view of economy and mechanical efficiency is the "endless wire" system, in which the fruit is despatched from one or more centrally situated points in the plantation on carrier pulleys which run on wires to the packing shed (Plate 16). Each pulley with a bunch attached runs on a fixed wire but is roped to an endless wire running round grooved wheels at each end of the system. When the bunch is off-loaded at the packing shed the pulley is transferred to a second fixed wire, hitched to the endless wire and returned to the plantation for reloading.

The system is not difficult to install, but it must be strongly built. Having selected the centrally placed point or points for despatching the fruit, a suitable site is chosen near the packing shed for a receiving station. This should be on a small rise if possible, so as to give the wires greater height. It is usually an advantage to build a staging at each despatching point to facilitate handling and loading of the fruit on steep slopes. If these loading points are kept to a fairly straight line the upper end of the wiring system can be fixed at a point higher up the hill and the wires run straight to the packing shed so that they pass directly over each of the stagings. The accompanying diagram (Plate 16) gives constructional details for the system.

PACKING.

Whilst the packing shed need not be an elaborate and expensive structure, it should be built in such a way that the fruit can be handled and packed in comfort under hygienic conditions. The framework may consist of bush timber and the sides of slabs, but a good roof and a sound floor are essential.

As the bunches arrive at the packing shed, they may be stacked or immediately de-handed and allowed to "sweat." The sweating period is at least eight hours and it is therefore usual to pack the fruit the day after it has been cut. After each consignment has been despatched, all damaged and waste fruit, together with any refuse, should be cleared away and dumped some distance from the shed.

In Queensland, most of the fruit sold locally is marketed in the bunch. Consignments to more distant markets are usually packed in standard $1\frac{1}{4}$ bus. cases as "singles" or, less commonly, as "hands." The skill and care shown by growers in harvesting and packing the fruit are reflected in its appearance on the market floor.

ARTIFICIAL RIPENING.

Fruit showing colour in the plantation usually deteriorates rapidly between the time of harvesting and the time it reaches the consumer. The bunch is therefore cut when the fruit is still green, and artifically ripened in special chambers with coal gas or other accelerators. Ripening practices vary, but tolerably good results are obtained with the Cavendish and Mons Mari varieties at coal gas concentrations of 0·1–0·3%, a relative humidity of 85% and temperatures of 65–70°F. The normal treatment period is about 5–7 days. The Lady Finger variety may be ripened under similar conditions but will tolerate higher temperatures than the Cavendish types.

LEGISLATION.

From time to time outbreaks of bunchy top, leaf spot, weevil borer and rust thrips have influenced production in particular areas. To cope with this situation, appropriate legislation has been included in *The Diseases in Plants Acts*, 1929 *to* 1948 and *The Banana Industry Protection Acts*, 1929 *to* 1937. The more important provisions which concern the grower may be summarised as follows:—

(1) Bananas may be planted only when permission has first been granted by the Banana Industry Protection Board through one of its several agents stationed in the more important producing districts. Such permits are granted if the proposed planting is in conformity with the planting policy issued by the Secretary for Agriculture and Stock in August each year. The planting policy defines permissible sources of planting material.

(2) Diseased plants must be controlled in the plantation. In the case of bunchy top the grower must treat infected plants with kerosene as prescribed, and then dig up and destroy the affected stool. He must also report outbreaks to the Department of Agriculture and Stock.

(3) The occupier or, failing the occupier, the owner of the land is required to dig out or otherwise completely destroy a banana plantation at the end of its cropping period.

ERADICATION OF BANANAS.

Until recently, most non-commercial plantations were dug out by hand, although cattle were sometimes used for eradicating bananas in the more accessible areas. Since the introduction of synthetic plant growth substances such as 2,4–D and MCPA for the control of broad-leaved weeds, these materials have been used for eradicating old banana plantations.

An injection of a 1% solution into the heart of the plant followed by spraying of any regrowth suckers with an 0·2% solution is quite effective. The commercial preparation is diluted with water to the required 1% strength of the active hormone and the solution is then injected at the rate of 15 c.c. (about ½ fluid ounce) for a fully grown plant, 10 c.c. (about one-third fluid ounce) for medium-sized plants, and 5 c.c. (about one-sixth fluid ounce) for small suckers.

Probably the most efficient and economical injector is built up from a small regulated jet sprayer in which the spray nozzle is replaced by a metal needle 8 in. long and sharply pointed, with a small hole just behind the point to allow the liquid to escape. A metal or rubber knapsack container is carried on the back and connected to the intake of the pump by rubber tubing. The sprayer is fitted with a graduated plunger rod and the dosage injected can therefore be regulated accurately. If the regulator is set to 5 c.c., the dosage for large, medium and small plants can be delivered according as the pump is given three, two or one strokes. The needle is plunged into the base of the pseudo-stem about 12 in. above ground level and at an angle of about 45 degrees to the vertical (Plate 17). It is then withdrawn about an inch and the requisite amount of solution pumped in. The whole operation is very simple and quite rapid.

The quantity of solution required for eradication will depend on the condition of the plantation, but as a general rule, unless the area is in an exceedingly overgrown condition, 5 gal. of a 1% solution should be sufficient to inject an acre planted on a 9 ft. x 9 ft. spacing. The quantity of the commercial preparation required may be calculated from this once the concentration of actual hormone in it is known.

Best results can be expected when the plants are growing vigorously and for this reason the injection should be carried out preferably from summer to autumn rather than in the cooler months (Plate 18). The effects of the treatment vary according to the size of the plant injected. If the plant has thrown a bunch or is about to do so, it usually dies in position without any very spectacular symptoms, but



Plate 17.

Eradication of Bananas with Hormone. Note method of holding injector and point of injection. The rubber tube connects with the knapsack carrier on the back.

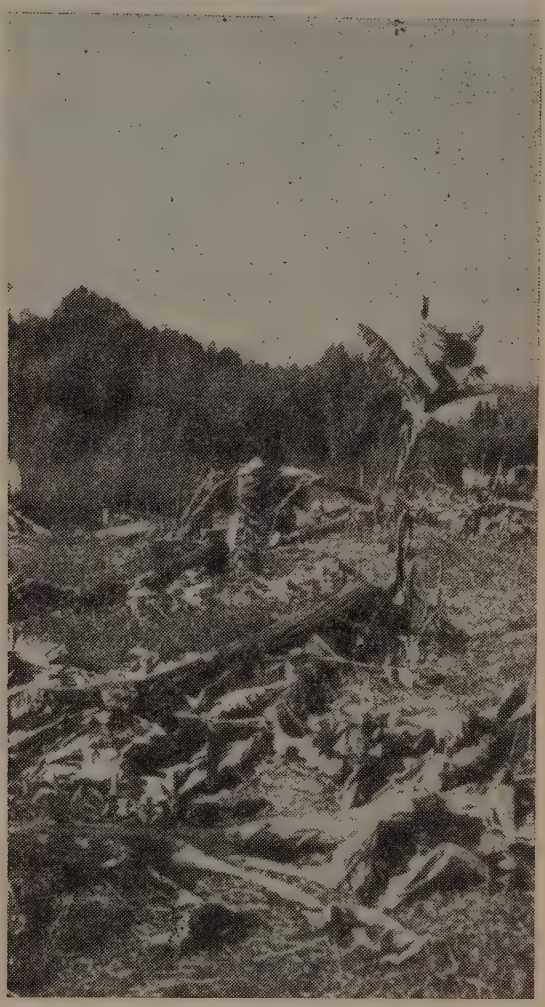
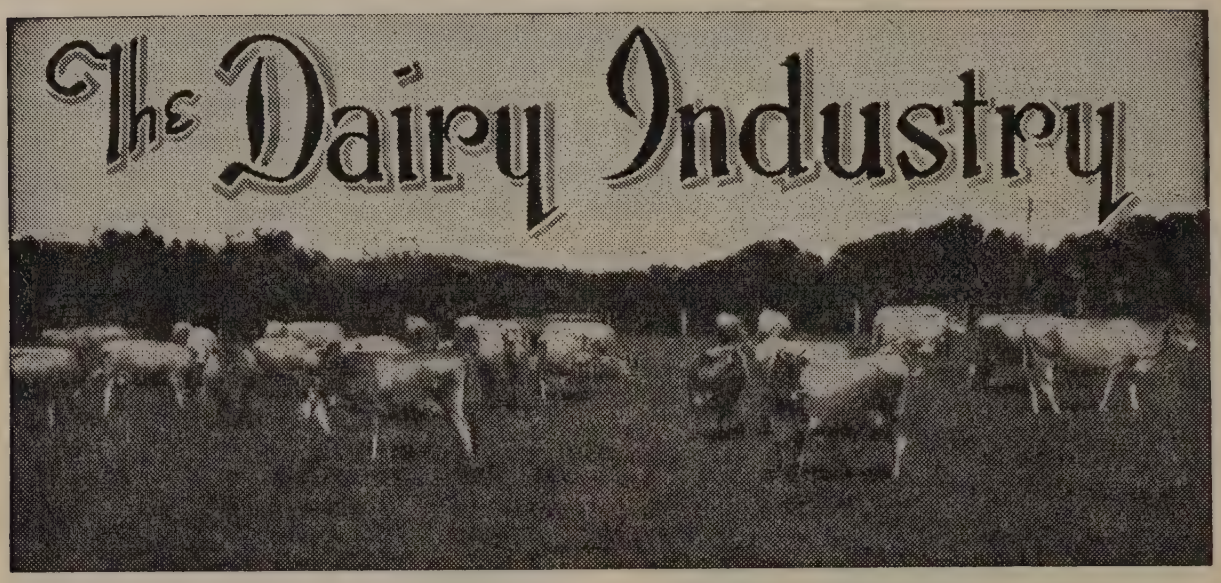


Plate 18.

Eradication of Bananas with Hormone. Cavendish stools injected with 1% 2,4-D seven days previously. Note stool in background leaning badly and small distorted suckers in centre still standing.

the bunch may be thrown prematurely, the bunch stem may snap off in the throat or the fruit may become abnormally elongated and rot without ripening. The flower usually dies fairly rapidly.

In the case of an immature plant, one side of the pseudostem grows much more rapidly than the other, so the plant cants over at a wide angle. As the plant leans over, the strain on the base becomes greater until finally the pseudostem snaps off just above the level of the corm; decomposition of the corm follows rapidly. If a 1% solution has been injected, the sucker buds begin to grow soon afterwards, but not all of the suckers will survive. Those which do so should be allowed to grow until they have developed broad adult leaves and then sprayed with a 0·2% solution of the original material—that is, one-fifth of the concentration used for the primary injection. A second spray treatment is often required a little later to complete the eradication, but this is on the basis of isolated spot applications only.



The Manufacture of Cheddar Cheese in Queensland.

E. B. RICE and T. A. MORRIS, Division of Dairying.

(*Continued from page* 184 *of the September issue.*)

THE PRODUCTION OF MILK FOR CHEESEMAKING.

The Quality of Cheese Milk.

A CLEANLY produced milk free from foreign matter and foreign flavours is necessary for successful cheesemaking. It must be capable of forming a firm clot when rennet is added and of allowing normal acid production by the starter organisms.

A cleanly produced milk will have a low bacterial content and this is desirable from the cheesemaker's point of view. He can much more readily obtain uniformity in manufacture when he consistently receives milk of low bacterial content, as this ensures a reasonably uniform starting point. It is recognised that lactic acid organisms are necessary in cheese manufacture, but it is much more satisfactory to add a known amount of a specific type of starter organism to milk of low bacterial content than to depend to some extent on a variable bacterial content of unknown organisms.

Both good and bad organisms (from the cheesemaking point of view) come from much the same sources on a dairy farm; thus it is necessary to insist on a milk of low bacterial content.

Milk Grading.

In order to ensure a supply of milk of the required quality for cheesemaking it is necessary to institute a satisfactory system of milk grading. This enables the suppliers of poor-quality milk to be detected and an endeavour can then be made to have the quality of their supplies improved.

The success of a grading system in improving milk quality depends on the pride the farmer takes in his work and the extent to which he is rewarded, or penalised, for good or poor milk as the case may be. The payment of premiums for good-quality milk or the imposition of penalties for poor-quality milk is justified.

The supplier of poor-quality milk makes it more difficult for the cheesemaker to produce satisfactory cheese even if he does not actually lower the grade of the cheese. Is it therefore right that he should receive the same price for his milk as the supplier who takes the extra trouble necessary to produce good milk, thereby facilitating the manufacture of high-grade cheese? In a co-operative dairy company, penalties paid by suppliers of low-quality milk serve as a compensation to the suppliers of high-quality milk for the lowering in cheese quality caused by the former.

A satisfactory system of grading milk for cheesemaking is one which will grade milk according to the extent to which it fulfils the requirements of good cheese-milk. Other points to be considered are the ease with which the test can be applied, the costs involved, and the reliability and consistency of the test.

In Queensland the grading of milk for cheesemaking is not compulsory, and while some factories pay for cheese milk on a quality basis, no set grading system is universally adopted. Where grading is carried out, the methylene blue test is mostly used. Occasionally the sediment test and the Wisconsin curd and fermentation tests are applied.

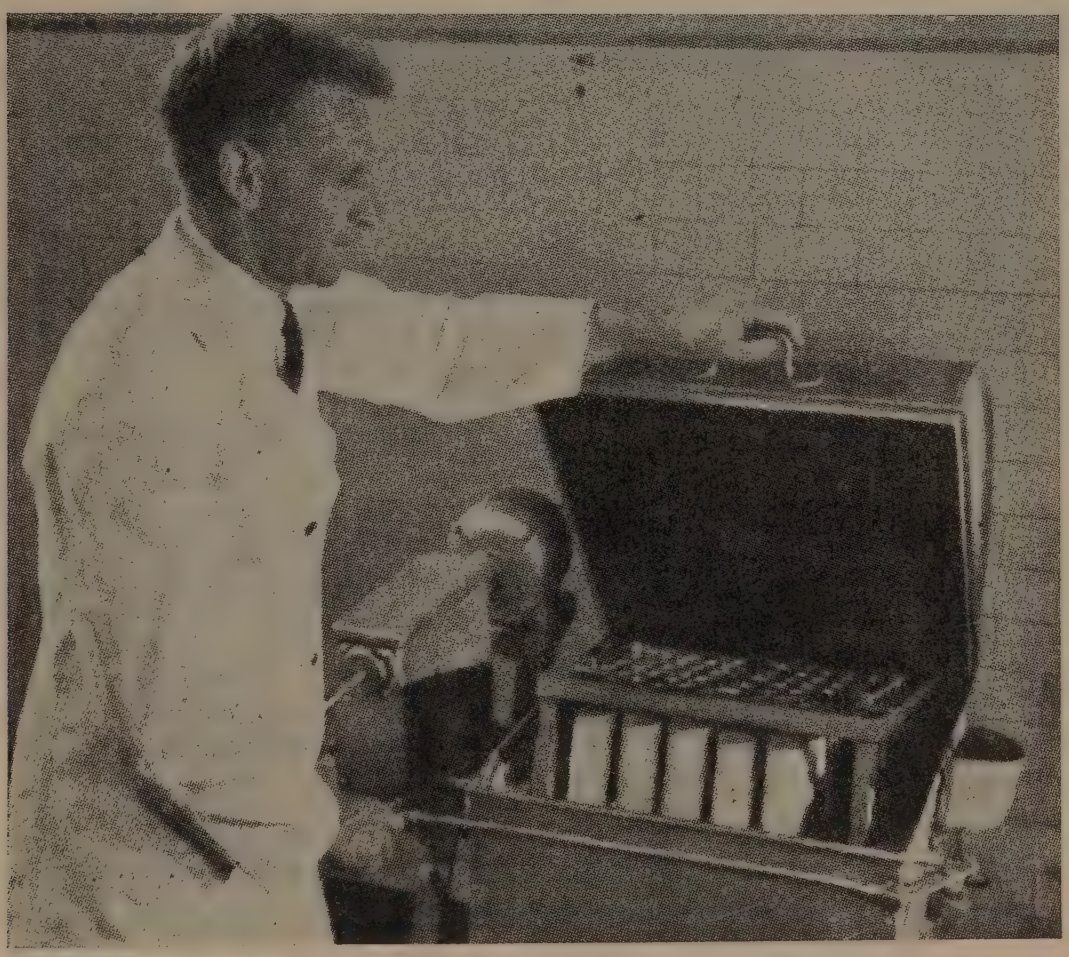


Plate 3.

Grading Milk by the Combined Curd and Reductase Test.

[*Photo by National Publicity Studios, New Zealand.*

A test which probably comes closer to satisfying all the requirements than does any other cheese-milk grading test is one devised in New Zealand and used there for some years past. This is the combined curd and reductase test (Plate 3), which, as well as giving a methylene blue reduction time, enables the judging of the curd formed with rennet

and incubated at 100°F. for 6 hours, on the basis of flavour, body and texture. The setting of the milk with rennet has the additional advantage that the milk samples do not have to be inverted every half-hour in the course of the methylene blue test.

Factors Affecting the Quality of Cheese Milk.

Troublesome defects in milk may arise from any one of the following sources:—

(1) Insanitary methods of production (bacterial defects).
(2) Lack of efficient farm cooling.
(3) Flavour-tainting weeds and fodder.
(4) Unhealthy cows producing abnormal milk.
(5) Improper use of penicillin.
(6) Absorbed flavours.
(7) Adulteration.

Insanitary Methods of Production.

It is generally accepted that of the inferior milk produced, approximately 90% of the low gradings is attributable to bacterial contamination. Freshly drawn milk from the healthy udder has a low bacterial count. At the same time, milk is an ideal food for bacteria, and every effort should be made to prevent their entry. If contamination is allowed, bacterial life may flourish and thus make the control of milk quality more difficult.

In controlling such bacterial defects as unclean or off-flavour, over-ripe, stale, fermented, yeasty, cheesy, and gassy milk, a thorough check-up should be made on the following sources of contamination and where necessary control measures instituted:—

(*a*) *Contamination from dairy equipment.*—All equipment should be free from structural defects. Perished rubbers, cracked and pitted metal surfaces and faulty soldering afford breeding grounds for bacteria by making thorough cleaning more difficult. Rusted utensils should be either retinned or replaced.

All necessary cleaning facilities should be provided. These comprise an adequate supply of boiling water, an approved detergent, a suitable metal washing-up trough, and machine line and can brushes.

Dairy equipment—benches, washing-up trough, draining racks, sterilizer or boiler—should be conveniently placed for efficient working and kept clean. All equipment, including vacuum tank and air lines, should be thoroughly cleaned and sterilized.

Efficient sterilization will help to reduce initial utensil contamination to a minimum, thereby increasing the keeping quality of the milk. Where hand milking is adopted, a 12-gallon copper will provide sufficient boiling water for cleaning and sterilizing purposes. Where milking machines are installed, a steam sterilizer or electric hot water unit is necessary.

(*b*) *Contamination during milking operations.*—The milker's hands and cow's udders should be kept clean and for this purpose each unit should be provided with clean cloths and a supply of clean chlorinated water. Dual udder-wash containers can be used to good advantage. Chlorine is a germicide and its use as recommended by the manufacturers will assist in preventing the spread of mastitis. Wet-hand milking should be discouraged. Bail-door sticks, milking stools and leg ropes should be maintained in a clean condition to obviate any chance of the milker carrying contamination to the milk during stripping. It is a wise practice to reject the foremilk, as it may be highly contaminated with undesirable organisms. The use of a strip cup to enable the foremilk to be examined before it is rejected is a very good practice as it aids in the early detection of mastitis.

(*c*) *Air-borne contamination.*—Pulverised manure dust is a menace not fully appreciated by most dairymen. It carries gas-forming organisms, which have the power of producing an offensive smell and flavour in the milk. These organisms gain access to the milk in three ways—direct entrance during the milking operation, lodgment on dairy equipment between milkings, and through the water supply tank by way of the roof.

To reduce contamination from the air, yards and bails should be cleansed daily and the dairy utensils and milk stored in a dust-free area. Prior to the commencement of milking, all utensils should be rinsed with chlorine solution. Cottonwool filter wads should be used for straining the milk in order to remove visible dirt.

(*d*) *Impure water supply.*—There should always be available at the milking shed an adequate supply of water for washing and rinsing dairy equipment. Water tanks at the milking shed should be regularly cleaned, and, if suspected of being impure, sterilized with a chlorine preparation.

Ropy and slimy milk is chiefly caused by impure water. Drinking water for cows should be wholesome and supplied in suitably constructed troughs which can be regularly cleaned. Cattle should not be allowed to wade in swamps, dams or waterholes, and the ground around the water troughs should not be allowed to become boggy.

(*e*) *Personal cleanliness.*—The persons engaged in milk production should be clean in their personal habits and in good bodily health, and when engaged in milking should wear clean overalls kept specially for this purpose.

Lack of Efficient Farm Cooling.

The cooling of milk considerably improves its keeping quality by retarding bacterial multiplication; hence efficient cooling of milk is a prime factor in connection with the production of milk for cheese manufacture. If efficient farm cooling were universally adopted there would be an appreciable reduction in the proportion of inferior milk being delivered to cheese factories. At the same time, cooling must not be accepted as an alternative, but used rather as an addition, to proper cleaning and sterilization of dairy utensils.

The temperature at which it is advisable to store milk on the farm is 50°–55°F. or lower, but this temperature is difficult to reach without the aid of mechanical refrigeration. Much can be done with various systems of water cooling, provided the water temperature is low enough, but no other system of aeration can be considered suitable for the purpose. A rippled surface cooler, coupled to a water-cooling tower (Plate 4) gives good results in some areas.



Plate 4.

A Water-Cooling Tower. When in operation, water is pumped from the pit through a milk cooler and back to the top of the tower, from where it falls in a spray, being cooled by evaporation as it descends.

After being drawn from the cow, milk has a temperature ranging from 94°F. to 100°F. depending on whether it is produced in winter or summer months and whether by machine- or hand-milking. At this temperature the development of undesirable types of bacteria is rapid. If cooling is not practised, the rate of fall in temperature is slow and considerable time elapses before the milk reaches within 2–4°F. of atmospheric temperature.

Thus the milk should be cooled as soon, and to as low a degree, as possible, and then held at this low temperature until transported to the factory.

Flavour-tainting Weeds and Fodder.

Strong tainting weeds like cressweed, carrot, mustard weed, Hexham scent and stinking roger cause undesirable flavours in milk. These undesirable weed taints may be lessened by change of ration, allowing cows to graze on such feed immediately after milking and taking them off some considerable time before the next milking. Cooling and thorough aeration of the milk will also assist in reducing weed taints.

The feeding of strong fodders (green lucerne, clover, etc.) and silage and mouldy foods also causes undesirable flavours. Control measures may be adopted as stated above for weed taints.

Unhealthy Cows Producing Abnormal Milk.

The quality of milk is adversely affected by the following circumstances:—

(*a*) *Cows just calved.*—Milk from freshly calved cows (colostrum milk) should not be included with the normal milk until at least 10 days after calving or until the milk is normal. This type of milk is of low fat percentage, is high in albumen content and imparts a slimy condition to the curd.

(*b*) *Cows far advanced in lactation.*—Milk should not be used from cows less than 15 days prior to calving. It is a sound practice to dry off all milking cows at least six weeks prior to calving. Late-lactation milk usually has high chloride and lipase contents and is frequently bitter in flavour.

(*c*) *Cows suffering from mastitis.*—Mastitis milk is sometimes responsible for slow-working vats in cheesemaking and should be excluded from the bulk supply. Careful dairy hygiene will assist in controlling this disease.

(*d*) *Cows affected with three-day sickness or any other disease which adversely affects the normal health.*—Milk from such cows should not be used for the manufacture of cheese.

Improper Use of Penicillin.

Penicillin is used extensively in the treatment of mastitis. It has an inhibitory effect on cheese starters and when in a sufficiently high concentration will prevent the proper development of acidity during cheese manufacture. Farmers are advised to discard the first milking subsequent to treatment of a cow with penicillin. Provided this is done there is not likely to be any trouble.

Absorbed Flavours.

Milk stored in an impure atmosphere or adjacent to any strong-smelling substance will readily develop an "off" flavour by absorption of the particular smell. Contact with new or perished rubber inflations, rag strainers and untinned utensils will taint milk, and it will readily take up disinfectant flavours if odorous disinfectants are used for washing cows' udders. Cleaners of a pungent-smelling nature should be avoided for the same reason. Exhaust fumes from engines and anything of an oily or kerosene nature will readily be absorbed by milk and cream, giving undesirable flavours.

Adulteration.

(*a*) *Watered milk.*—This may be detected by the use of the lactometer or by a determination of the freezing point. The adulteration is mainly caused by deliberate watering or by allowing flushing water from machines to flow into the milk. The watering of milk is an offence under the Dairy Produce Acts. The addition of impure water is detrimental to quality, and any water added lowers the yield of cheese and may increase cost of manufacture.

(*b*) *Skimmed milk.*—This is due to skimming cream off the night's milk or separating portion of the milk and pouring the skimmed milk into the bulk supply. Skimming may be detected by the use of the lactometer. Skimming causes dry, hard, corky body and flat flavour and decreases the yield of cheese per 100 lb. of milk received.

(*c*) *Preservatised milk.*—Chemical preservatives (formalin, boric acid, saltpetre, etc.) are detrimental to cheesemaking. Most chemical preservatives affect the action of rennet and inhibit the growth of the starter organisms.

Preservatives may be detected by various chemical tests. Milk adulterated with chemical preservatives should be rejected at the cheese factory.

[TO BE CONTINUED.]

HAVE YOUR SEEDS TESTED FREE

The Department of Agriculture and Stock examines FREE OF CHARGE samples representing seed purchased by farmers for their own sowing.

The sample submitted should be representative of the bulk and a covering letter should be sent advising despatch of the sample.

MARK YOUR SAMPLE

Sample of ..... seed
Drawn from ..... bags
Representing a total of .....
Purchased from .....
Name and Address of Sender
Date.....

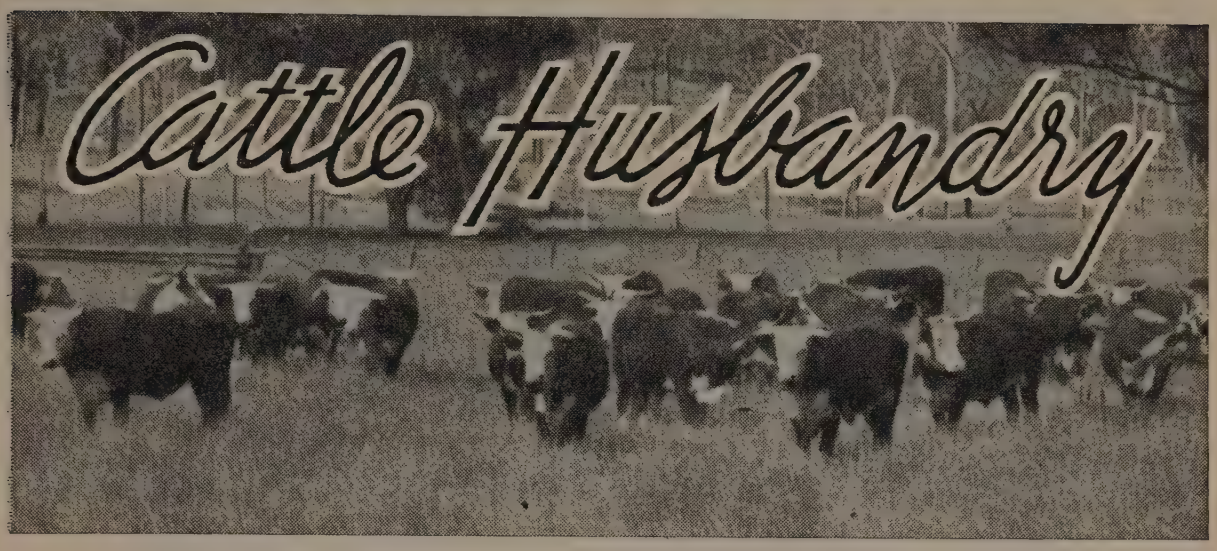
SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

Vegetable Seeds - ½ oz.

SEND YOUR SAMPLE TO—**STANDARDS OFFICER,**

DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.



Improving Dairying on the Marginal Coastal Lands of Kin Kin—Mooloolah.

G. I. ALEXANDER (Cattle Husbandry Branch), A. HEGARTY (Agriculture Branch), and G. C. KENNY (Veterinary Services Branch).

ON coastal dairy farms in the Kin Kin-Mooloolah area of south-eastern Queensland, where the soils are sandy and of low fertility, there are many problems confronting the dairy farmer. The annual production per cow is amongst the lowest in Queensland. This is considered to be a reflection of the poor nutritional quality of the feed available to stock and the consequent poor condition and health of the animals. Seasonal conditions influence the production of pasturage and crops for stock, but in recent years even under good seasonal conditions cattle have been found to suffer from emaciation and loss of production, and some deaths have occurred.

During 1950, an excellent year in coastal Queensland, many instances of emaciation and losses of dairy cows and calves were recorded. These losses seemed to be associated with very low soil phosphate and low phosphorus and copper levels in the blood of the grazing animals. With these losses as a background, demonstrations were undertaken under the Commonwealth Dairy Industry Efficiency Grant in an endeavour to overcome the difficulties.

Four types of project were undertaken in view of the complex nature of the problems confronting farmers. These were:—

(1) Correction of the low phosphorus balance of the cattle by the use of

  (*a*) Phosphorus supplements in the diet of the cows.

  (*b*) Phosphorus as a component of crop and pasture fertilizer mixtures.

(2) Correction of the copper deficiency which occurs in stock, especially after periods of high rainfall, by the use of

  (*a*) Copper supplements in the diet of the cows.

  (*b*) Copper as a component of crop and pasture fertilizer mixtures.

(3) Growing of fodder crops in regular winter and summer cropping programmes to provide adequate bulk for a longer period of the year.

(4) Topdressing and re-establishment of the more desirable pasture grasses to enable stock to obtain sufficient roughage of good quality.

On the farm selected, a number of cows had died from undetermined causes during the period of satisfactory seasonal conditions experienced in 1950. On investigation death was considered to be due to poor nutrition and poor mineral balance of the dairy cattle. Rearing of calves presented a problem, and scouring calves did not respond to drenching with phenothiazine, the normal treatment for worms; this suggested that copper deficiency might be an important factor.



Plate 1.

An Emaciated Cow Before Farm Improvement was Undertaken.

Emaciated cattle on the property (Plates 1 and 2) had a rough, bleached coat and excreted a profuse, foul-smelling scour. Such cattle also suffered from faulty dentition, and young milking stock were stunted in growth. In addition to these symptoms, dairy production was decreased; cattle were averaging only 3 lb. of milk per day and did not respond to the normal methods of supplementary feeding practised in the district.

Biochemical Investigations.

In August, 1950, cattle were bled and examinations were carried out to determine the phosphate and calcium levels of the blood. Both phosphate and calcium levels were low, indicating the existence of a borderline phosphorus status. Haemoglobin estimations were carried out and these were also found to be low, this condition indicating the possibility of copper deficiency. A further indication of copper deficiency was given by the liver analysis of a cow too weak to walk. On analysis, this liver was found to contain only 8.5 p.p.m. copper, indicating that the animal had been copper-deficient.

Following these tests for phosphorus, calcium and copper, the farmer was recommended to feed sterilized bonemeal at the rate of 3 oz. per head daily, with copper sulphate added at the rate of 1 part to 100 parts bonemeal to correct the suspected copper deficiency.

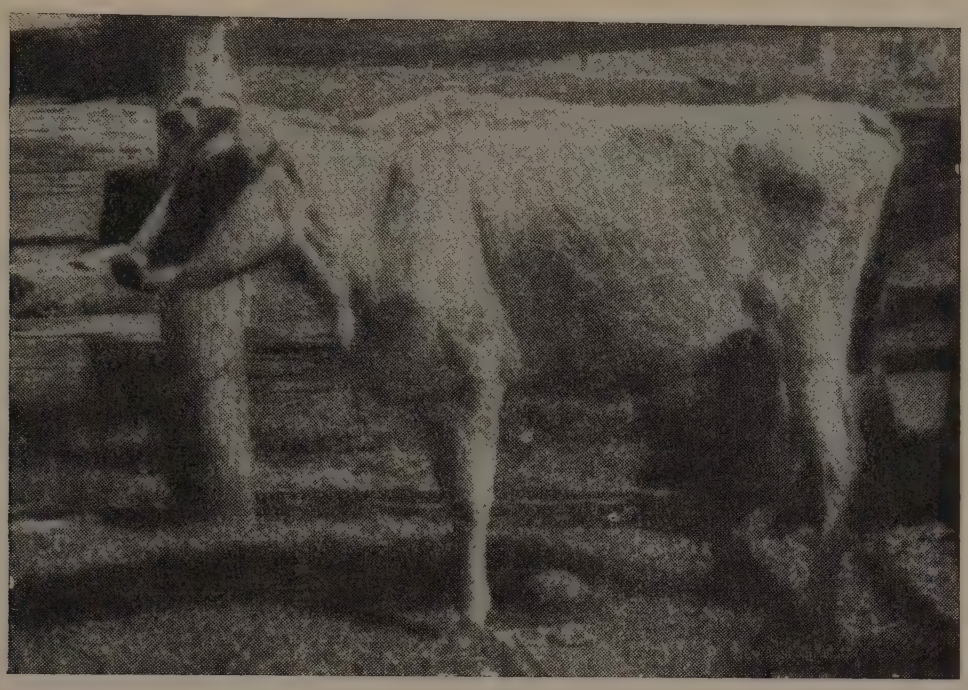


Plate 2.

A Heifer Showing the Rough Coat Characteristic of Cattle on Unimproved Areas.

Agricultural Investigations.

A survey of the area showed the soils to be sandy and analysis revealed them to be of low fertility. Available soil phosphorus was low and associated with high acidity. Production of grass and crops without fertilizer was barely sufficient to maintain cattle alive. Soil fertility had so declined that the pasturage consisted of closely grazed mat grass (*Axonopus affinis*), blue couch (*Digitaria didactyla*) and bluetop (*Ageratum conyzoides*), and it was doubtful if cattle were obtaining sufficient roughage for normal health. Attempts had been made by the farmer to grow crops, but due to the use of inadequate amounts of fertilizer, yields were disappointing and uneconomic.

To provide sufficient good roughage to supplement the poor pasturage available, it was obvious that some form of cropping programme was necessary, and this important phase received attention in addition to the direct treatment of cattle.

The demonstrations were commenced in May, 1951, when the district was entering a severe drought. Rainfall during the period covered (May, 1951, to April, 1952) totalled 25.03 in., as compared with the average rainfall for the area of 45 in.

Therapeutic Treatment of Cattle.

During the 12 months' period of the demonstration dairy cattle were fed daily, in the bails, 8 oz. of mixed crushed grain to which was added 3 oz. of a mineral mixture comprising ground bonemeal 50 parts, coarse salt 50 parts, and copper sulphate 1 part.

All cattle regularly receiving this mixture remained in good condition, with glossy coats (Plate 3). While mineral supplements were being fed, no cattle died, though on neighbouring farms stock were being lost due to drought and poor nutrition. Scouring of cattle and calves ceased and the farmer was able to rear a number of healthy calves for herd replacement purposes (Plate 4.)



Plate 3.

Cattle in Good Condition Following Treatment.



Plate 4.

Calves Reared on the Property After Improvement.

In April, 1952, after 12 months of mineral feeding, the blood levels of phosphorus, calcium and copper were found to be satisfactory, with no trace of the earlier deficiencies.

Cropping Programme for Production of Grazing Crops.

To improve the low nutritional value of the feed available, areas of land were prepared for winter and spring fodder crops, and these areas were also used to provide late summer grazing.

Initial plantings of 10 acres of oats were made in early May, 1951, sufficient rain being received to ensure a good strike, and in late May an area of 4 acres was sown to field peas to help provide late winter grazing.

Following extensive grazing of these winter plantings, the entire area was sown to Poona peas to help improve the nitrogen status of the soil as well as to provide late summer grazing for the dairy herd.

Sufficient fertilizer was applied in the May application to provide enough plant food for two grazing crops in the 12 months, and the suitability of this treatment was borne out by the excellent crop of Poona peas grown on residual phosphate.

Cost of Sowing and Fertilizing Supplementary Grazing Areas (Per Acre).

	£	*s.*	*d.*
A. Oats followed by Poona pea—			
1½ bus. Vicland oats	1	2	6
2 cwt. superphosphate + 1 cwt. sulphate of ammonia	3	10	0
15 lb. copper sulphate	0	15	0
30 lb. Poona pea (sown in early summer)	1	10	0
Annual cost of area A per acre	£6	17	6
B. Field peas followed by Poona pea—			
1½ bus. Dun field pea	2	13	0
2 cwt. superphosphate + 1 cwt. sulphate of ammonia	3	10	0
15 lb. copper sulphate	0	15	0
30 lb. Poona pea (sown in early summer)	1	10	0
Annual cost of area B per acre	£8	8	0

The total cost of seed and fertilizer for the equivalent of 28 acres of grazing crops over the 12-month period May, 1951, to April, 1952, was £102 2s., or a unit crop cost of £3 13s. per acre.

Utilization of Grazing Crops.

Oats and field peas established in May provided excellent grazing despite low rainfall; with the aid of an electric fence the milking herd was grazed on strips for three hours daily from July to November. The succeeding crop of Poona peas established in late November provided useful grazing from February to April and showed the versatility of leguminous grazing crops for this area.

Follow-up work was scheduled for the winter of 1952, using the same programme as in 1951, but with a reduction of fertilizing materials in view of the improvement in soil fertility effected.

Pasture Investigations.

Pasture topdressing was undertaken on a 3-acre field in which kikuyu grass had been established by the farmer and where growth had been negligible. A fertilizer dressing at 3 cwt. per acre (2 cwt. superphosphate plus 1 cwt. sulphate of ammonia) was applied in December,

but lack of suitable rain until late January prevented early growth. Following this late January rain, the pasture grew rapidly, with excellent colour and bulk, and was submitted to heavy grazing during March and April. This small preliminary demonstration showed the value of using fertilizers containing nitrogen and phosphorus for promoting early grass growth after seasonal rain in this area where pasture legumes are absent and a permanent deficiency of available soil nitrogen exists. Where cattle are in need of bulky feed, such fertilizers appear to offer a temporary solution to the problem of poor growth in pastures which do not contain a legume.

Production Figures.

The data in Table 1 show a considerable lift in production during the period of grazing on oats and Poona pea. In Plate 5 the production of the herd concerned on marginal land is compared with that of the Pomona Herd Recording Group which comprises 20 herds. Many of these herds are depastured on paspalum and kikuyu pastures on scrub farms in more favourable areas, and supplementary feeding of the milking herds is commonly carried out.

TABLE 1.

PRODUCTION TREND RELATIVE TO AVAILABILITY OF SUPPLEMENTARY GRAZING.

—	1951.					
	May.	June.	July.	August.	September.	October.
Number of Cows in milk ..	18	15	9	11	12	17
Average daily milk per cow (lb.)	3·1	2·3	6·1	7·9	7·4	8·2
Total milk per day (lb.) ..	55·8	34·5	54·9	87·4	88·5	139·4
Rainfall (points)	142	64	11	73	44	297
Type of feed	Mat grass	Mat grass	Oats	Oats	Oats	Oats + Field peas

—	1951.		1952.			
	November.	December.	January.	February.	March.	April.
Number of Cows in milk ..	24	26	26	26	25	25
Average daily milk per cow (lb.)	7·0	5·7	4·6	5·3	6·8	7·3
Total milk per day (lb.) ..	167·9	147·5	121·5	138·0	170·0	183·0
Rainfall (points)	41	84	212	175	590	338
Type of feed	Oats + Field peas	Mat grass	Mat grass	Poona peas	Poona peas + Fert. Kikuyu	Poona peas + Fert. Kikuyu

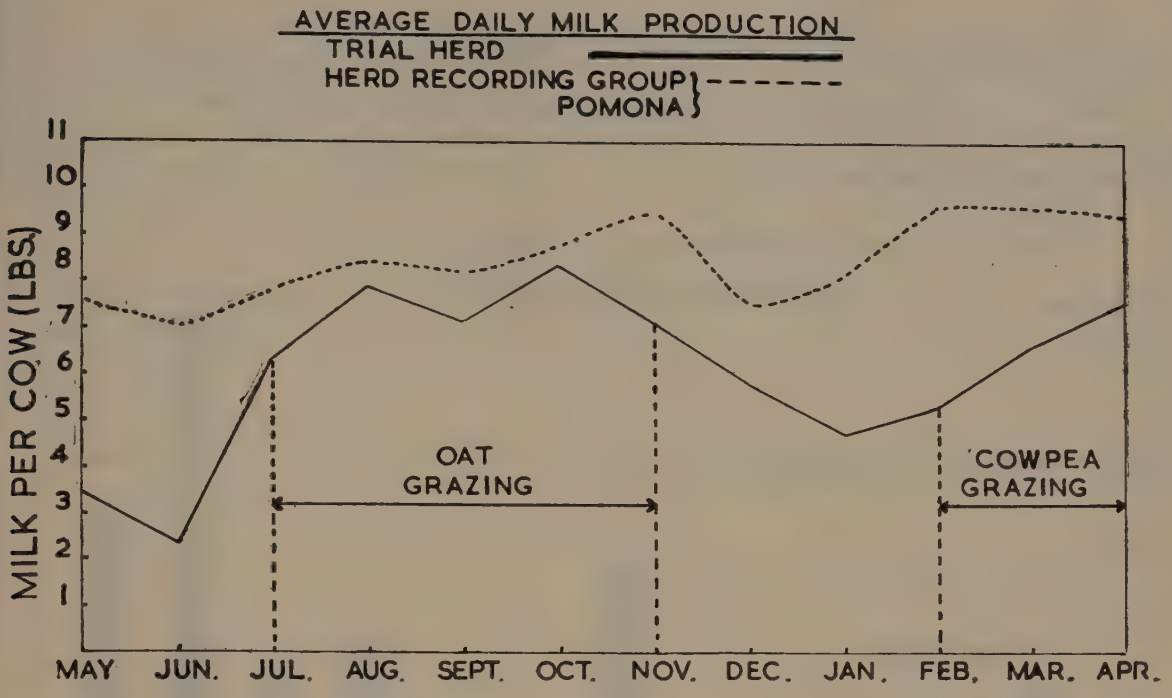


Plate 5.

Comparison of Milk Production by Cows in a Good Dairying District (Pomona) and those on the Poor Farm on Improved Feed.

The graph illustrates the results that can be obtained on these and similar lands by the grazing of suitable fodder crops, combined with mineral supplements, where animals suffer from lack of feed and from mineral deficiencies during certain periods of the year.

During the period July to November, when milking cattle had access to grazing oats, a production increase of 48.6% over the corresponding period in the base year was recorded. Such a trend for five consecutive months clearly shows the value of the demonstrational work undertaken, and emphasises the benefits of using suitable grazing crops, grown with adequate applications of fertilizers.

TABLE 2.

COMPARISON OF MONTHLY PRODUCTION ON TEST FARM, 1950–51 AND 1951–52.

Month.	Butter (lb.).	Kin Kin Rainfall (points).	Month.	Butter (lb.).	Kin Kin Rainfall (points).
1950.			1951.		
May	129	378	May	108	90
June	111	456	June	58	79
July	85	1,179	July	81	Nil
August	69	95	August	114	52
September ..	81	52	September ..	119	115
October	100	427	October	199	295
November ..	131	660	November ..	171	24
December ..	184	493	December ..	150	166
1951.			1952.		
January	271	1,838	January ..	159	404
February ..	248	443	February ..	180	251
March	237	504	March	236	589
April	171	34	April	201	438
Total ..	1,825 lb.	6,459	Total ..	1,786 lb.	2,503

As shown in Table 2, the herd's butter production for the drought period May 1951 to April 1952 was practically equal to that of the previous 12 months, when the area received excellent seasonal conditions and an extra 29 inches of rain over the year during which the demonstration was carried out.

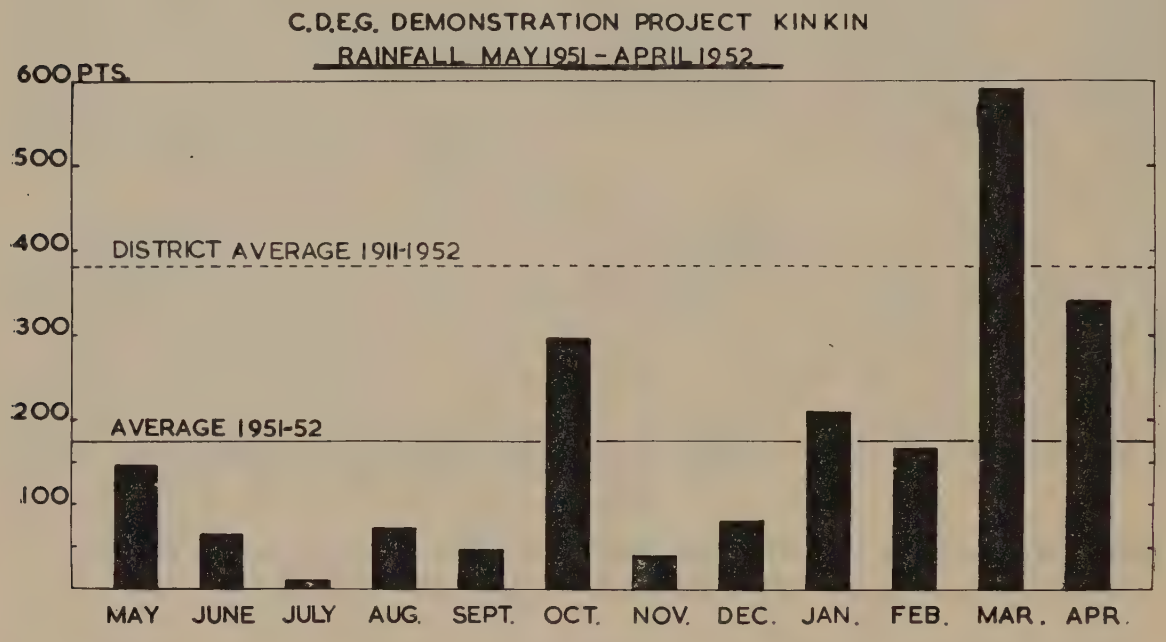


Plate 6.

Rainfall at Kin Kin during the Demonstration Period.

Despite the severe drought production was held at reasonable levels and no stock were lost through poor nutrition.

A combination of adequate, good-quality grazing and correct mineral balance for cattle points the way to the successful utilisation of these marginal coastal lands. On soils which are leached and of low fertility, the correct application of soil amendments, fertilizers and trace elements will enable dairying to be carried out at a reasonably satisfactory standard.

VOL. III. OF THE "QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK."

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Safety Catches for Forcing Yard Gates.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

WHEN forcing cattle towards a crush it frequently happens that the cattle surge backwards before the gate is secured, resulting in inconvenience, delay and possibly injury to both man and beast.

The accompanying drawings illustrate simple and effective safety catches for the gate of the forcing yard which can be constructed by any handy man.

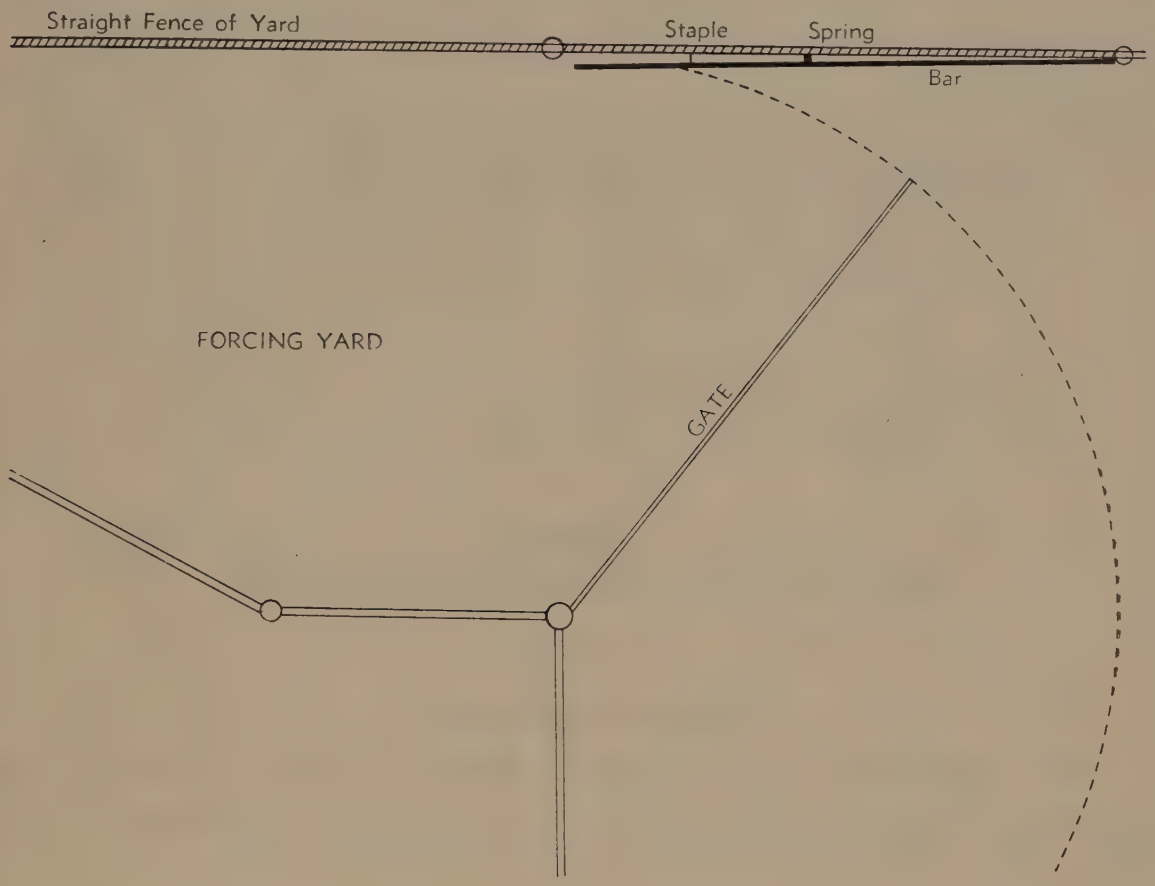


Plate 1.

Ground Plan of Safety Catch for Forcing Yard Gate.

Spring Catch.

Plate 1 shows the ground plan of a spring safety catch, and Plate 2 gives the elevation, showing the spring and the bar.

Materials Required.—

One 4 x 2 hardwood bar sufficiently long to reach from the first post behind the gate to the back of the closed gatehead, leaving about 1 in. play between the end of the bar and the gatehead.

Two plates of 1½ in. x ¼ in. flat iron 18 in. long bent at right angles.

One 5 in. x ½ in. bolt.

Four ½ in. spikes or bolts to secure the elbow plates to the yard post.

One main leaf of car or similar spring.

One "U" bolt to carry bar. This is bolted through the rail and its length will depend on the thickness of the rail. The bolt should be set just behind the point of contact of the gate with the bar.

Bolts or wire to attach the end of the spring to the rail.

It will be noted that the secured end of the bar butts against the post and is hinged onto it by the bent plates and bolt.

The operator can swing the gate from a safe distance behind the cattle. In the act of closing, the gatehead slides along the loose end of the bar and depresses the spring. As the gate clears the end of the bar, the recoil of the spring forces the end of the bar behind the gatehead, thus effectively securing it.

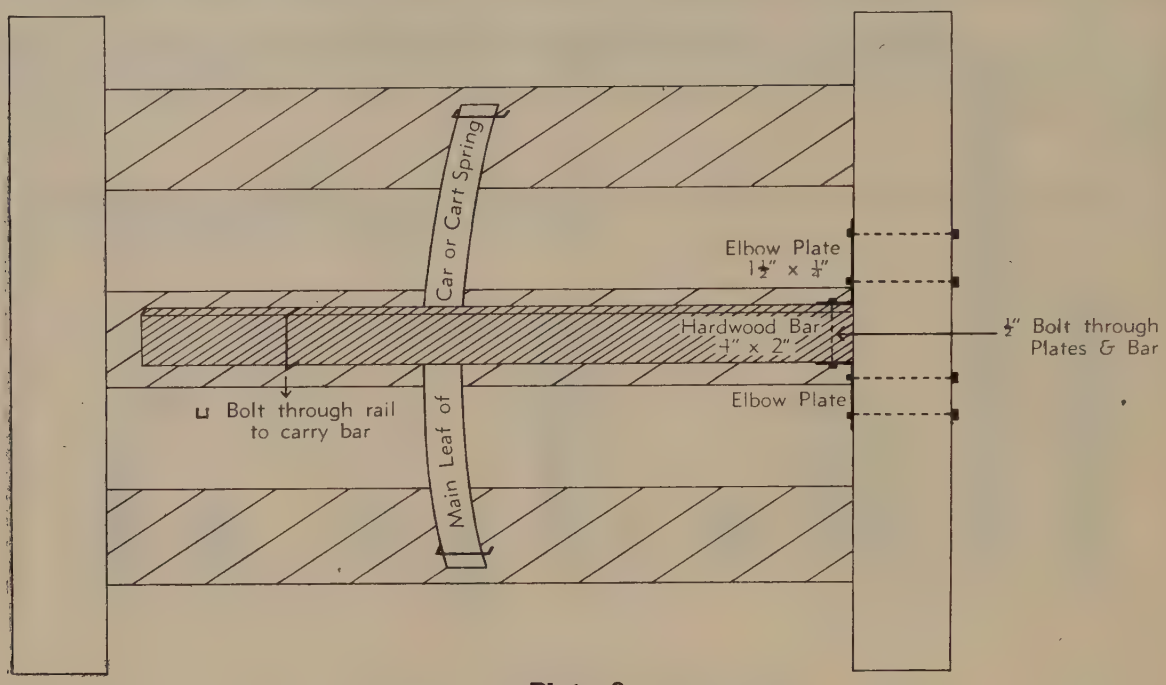


Plate 2.

Elevation of Safety Catch, Showing Spring and Bar.

Hinged Prop Catch.

The hinged prop type of catch is shown in Plate 3. This is quite effective but somewhat more cumbersome than the spring and ratchet types. Angle iron or hardwood can be used for the prop.

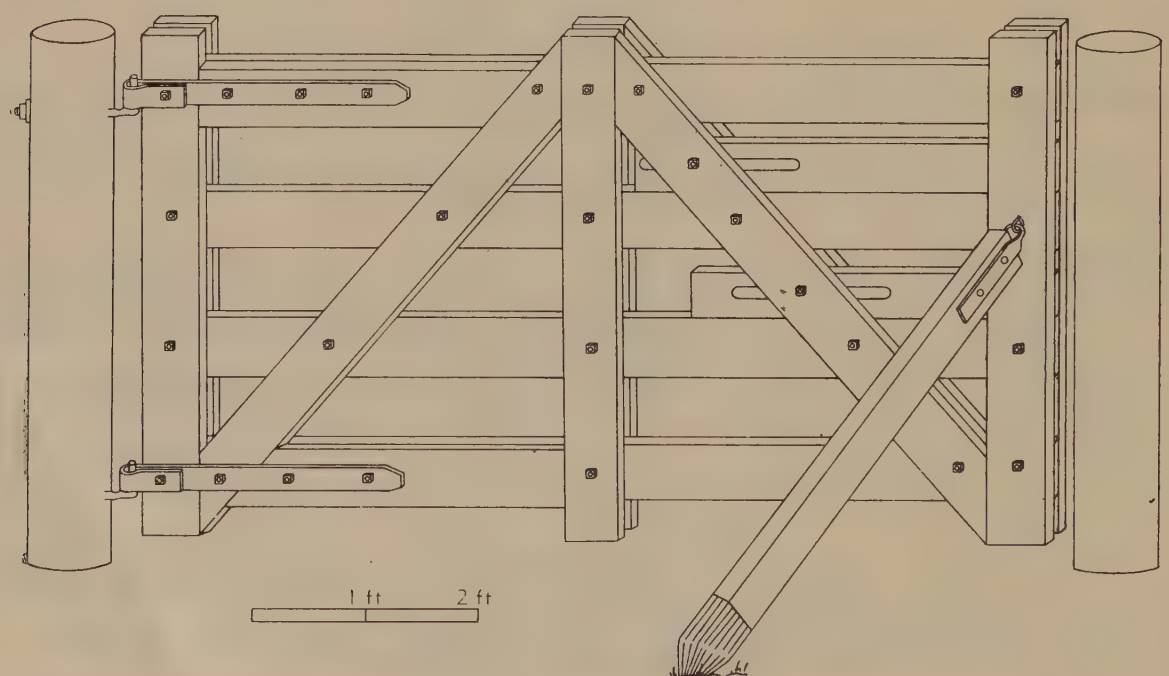


Plate 3.

Diagram of Hinged Prop Catch.

Ratchet Catch.

Plate 4 shows a ratchet type of catch. This is an ordinary drop-latch type, that slides along the ratchet, bolted to the rail and dropping into position. Tough hardwood should be selected for the latch and ratchet.

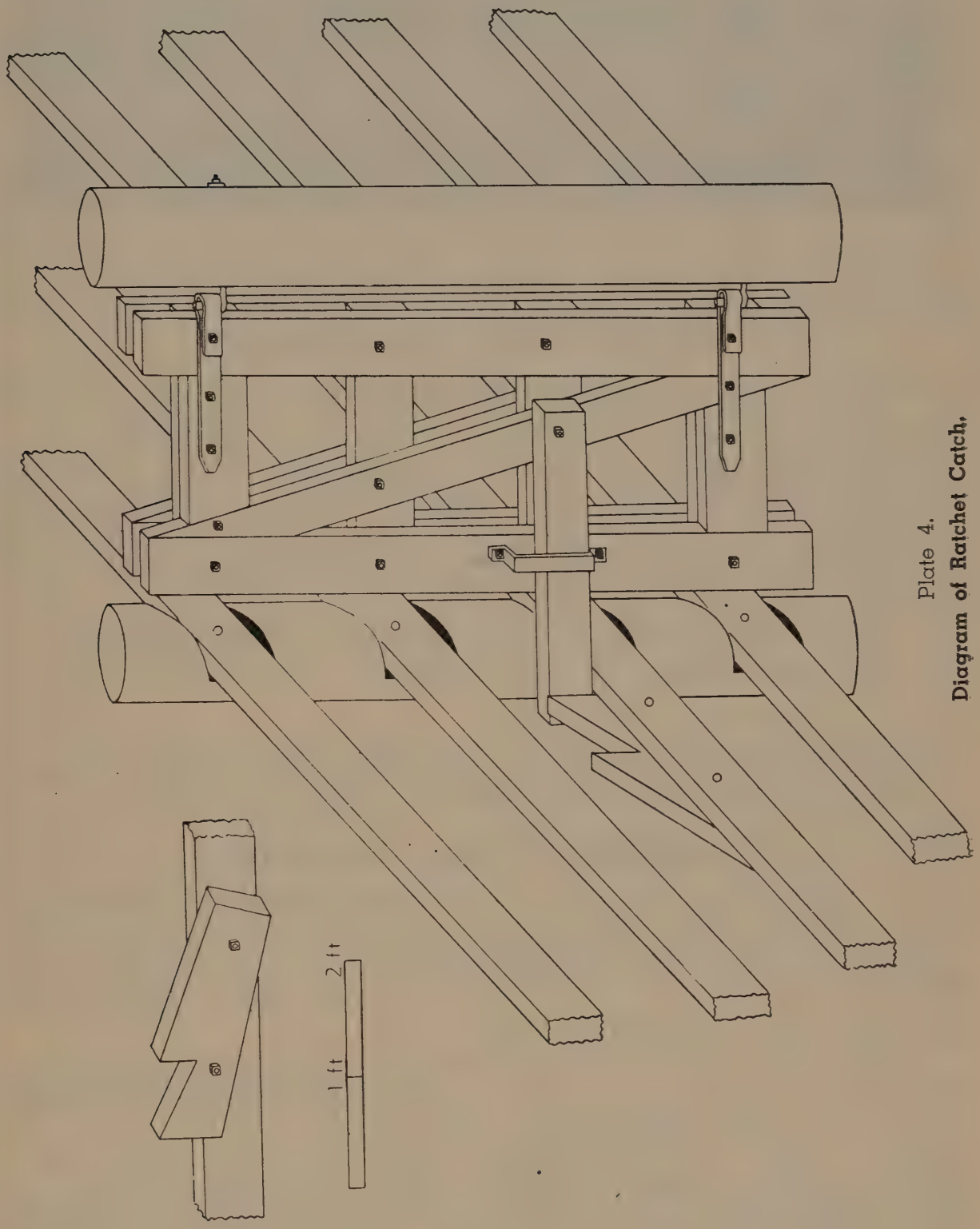


Plate 4.
Diagram of Ratchet Catch.



Beating Sheep Blowflies.

G. R. MOULE, Director of Sheep Husbandry.

THERE is no single method for the control of blowfly strike in sheep. Publicity during the past 10 years for the Mules operation, tail stripping and the use of DDT and BHC may have drawn emphasis away from the use of a balanced plan in preventing blowfly strike. The Sheep and Wool Branch of the Department of Agriculture and Stock has always felt that blowfly control depends upon the use of a co-ordinated plan. It is most important to forecast waves and to act before the flies start.

The two main periods of blowfly activity in Queensland are:—

(1) Late summer to early autumn.

(2) Spring to early summer.

In most years the length of the fly-waves depends on the amount of rain which falls or has fallen during the last few months.

DIFFERENT TYPES OF STRIKE.

Crutch strike in ewes causes most trouble in most years in Queensland. Crutch strike starts on the inner side of either back leg. Strike may start on other parts of the breech, such as the tail or the udder. The latter may be struck after it has become stained with afterbirth voided by lambing ewes.

Body strike may start on the point of the shoulder, on the wither, back or rump, or on any part of the body other than the breech, head or pizzle. In most areas and in most years, body strike occurs only during or just after good seasons. The Stanthorpe district is a notable exception. Body strike may occur there during the winter, as the heavy dews on long grass keep the point of the shoulder wet. A severe wave of body strike can be hard to handle, and losses in terms of sheep and wool can be heavy. Fortunately, bad waves occur only every seven or eight years.

Pizzle strike occurs only on wethers and rams. The latter may also be struck on the head.

WORK TO A CO-ORDINATED PLAN.

A co-ordinated plan for blowfly control always pays. The one recommended by the Sheep and Wool Branch includes several steps. They are applied at different stages of the sheep's life and are easy to follow.

A. At Lamb Marking.

(1) Cut the lamb's tail level with the tip of the vulva.

(2) Cut the tail so the bare skin from the under-surface of the tail is long and heals back over the severed stump.

B. At Weaning Time or at any Time up to When the Sheep Become 2-Tooths.

(1) Do the Mules operation. Wethers as well as ewes may be treated if crutch strike is a problem in wethers in most seasons. The tail strip can be removed while doing the Mules operation if this was not done at marking. The Mules operation will protect sheep against strike starting in the crutch. It will not protect against strike starting on the udder after lambing, or on the tail or any other part of the sheep's body.

C. Subsequent Treatment.

(1) *Crutching.* In all cases a mid-season crutching is recommended.

(2) *Jetting and Spretting.* Jetting or spretting with arsenic is effective and cheap. It can be used during severe fly-waves if the sheep are carrying more than six weeks' wool. Sheep carrying small strikes may be jetted with arsenic. Because it is so poisonous it may cause injury to sheep carrying large strikes. If the jetting fluid is re-used, the cost of arsenic is about £3 10s. per 1,000 sheep treated. Rams should not be treated with arsenic prior to joining, because it may cause temporary infertility. However, it can be applied to the pizzle of wethers.

(3) *Spraying with DDT.* DDT remains poisonous for a fairly long time after it is applied to the wool. It is used in a 1.0 per cent. solution to protect against body strike. It can be put on the sheep from the top sprays of a shower dip or by a curved spray boom which is bent to fit over the back and sides of the sheep. "Fishtail" or "Cyclone" nozzles are fitted to the curved boom and the fluid is pumped through by a jetting plant running at about 150 lb. per square inch. This gives a finely atomised spray. About one-third to half a gallon should be used for each sheep. The cost for materials is in the vicinity of £40 per 1,000 sheep.

DDT will not kill blowfly maggots. It protects the sheep by stopping the flies from laying their eggs.

D. Emergency Treatment.

All of these methods aim at preventing strike. It has now been shown that the fly which starts most of the strike breeds in struck sheep. Therefore, any methods which protect sheep from being struck help prevent serious blowfly waves. However, sudden changes in the seasons, floods and the like can prevent the handling of stock for shearing, crutching, jetting, spretting and/or spraying. When this coincides with a severe fly wave, a large number of sheep may be struck. In such circumstances, emergency methods may have to be applied urgently. Hand-dressing is too laborious, and it is often impossible to get crutchers.

BHC is the most useful material to use in such a case. It is poisonous to blowfly maggots, but will not injure the sheep, even if it is jetted or spretted onto large strikes. It can be applied copiously to struck sheep, at as much as 2 gallons of a 0.05 per cent. solution per head. It can be applied by a jetting plant, spretter or, if body strike occurs, from the top sprays of a shower dip.

BHC used at this strength will protect sheep from restrike for from 3 to 30 days, depending on the weather and the severity of the fly-wave. It may be necessary, therefore, to treat the struck sheep again soon after the initial application of BHC. Its main value, then, is in handling an emergency. Applied at the rate of 2 gallons per head as a 0.05 per cent. solution, BHC would cost about £125 per 1,000 sheep treated.

Forecasts are Important.

The use of a co-ordinated plan and anticipation of fly waves are the keys to success in the control of blowfly strike in sheep. The adoption of a plan similar to the one set out is an easy matter, although it has to be co-ordinated with lambing dates and the like.

The anticipation of fly waves is a little more difficult. For that reason a forecast is read during the A.B.C.'s Country Hour each Tuesday. It gives woolgrowers up-to-date information about weather conditions in their districts. It gives warnings about the development of fly-waves and suggests the use of protective measures at appropriate times.

Detailed information about the use of any of the methods recommended can be obtained from your nearest Sheep and Wool Advisory Officer.

FORECASTING BLOWFLY STRIKE IN SHEEP.

"It is bad management to get caught by blowflies," is an old saying in the sheep industry. But it is not always easy to forecast a fly-wave. Woolgrowers in Queensland know only too well that once blowfly strike gets out of hand, losses can be serious. The old maxim that prevention is better than cure applies to blowfly control—except that you often need prevention by the ton instead of by the ounce! The Sheep and Wool Branch of the Department of Agriculture feels timing is important in using preventive measures against fly strike. You have to be able to forecast fly waves if you want to protect your sheep. To forecast correctly you have to know the effects of the weather on the life cycle of the blowflies that cause strike.

The Flies Which Strike Sheep.

Most strikes are started by the green blowfly. The female is a prolific egg layer. Sheep have a natural attraction for her but she lays most commonly on patches of wet wool. The eggs hatch into creamy coloured smooth maggots, which move quickly into nearby parts of the fleece. Other blowfly maggots prey on those of the green fly. If they did not, we could resign ourselves, willy-nilly, to handing the world over to them. They reproduce so quickly that they could soon challenge our comfort and welfare.

Because she starts the strike, the green fly is called the primary fly. The smell produced by the activity of her maggots attracts other flies. These are known as secondaries. They most commonly lay their eggs on existing strike. These hatch into hairy maggots, which

have strong mouths and sharp claw-like teeth. They are the greatest natural enemy of the green fly's smooth maggots. For this reason, very few smooth maggots which hatch out in carcases complete their life cycle. On the other hand, many thousands of primary green flies may be bred from a single large strike on a live sheep.

As the struck sheep is the main breeding ground of the green fly, the prevention of strike is most important.

How the Weather Influences Fly Populations.

There are never many blowflies during very hot weather or when there is a cold snap. However, the weather affects blowflies in other ways. The eggs hatch more rapidly and the maggots grow more quickly when the weather is warm and humid. These conditions also shorten the resting stage between maggot and mature fly. As a result, a mature female fly can develop from an egg in as few as 17 days. As each female fly can lay anything up to 3,000 eggs in her lifetime it does not take long to work up large fly populations. In theory, it is possible for a pair of flies to have enough descendants to outweigh the world in two years!

If rain falls when the weather is warm and humid, the wool may stay wet. This renders it attractive to green blowflies and they soon deposit their eggs. The moist wool provides the maggots with ideal conditions for growth and development and the stage is set for the first few strikes which may herald a wave.

In Queensland, air temperatures during the autumn and spring or early summer favour the development of blowflies. They hasten the stage between the maggot and the young fly. When the new crop of flies emerge from the ground they form the basis for a new fly wave if conditions suit. The resting stage in the ground can extend over several months until conditions are suitable for the young flies to emerge.

The time of the year and the weather since the last severe fly-wave affect the number of flies which emerge. If some part of the wool is not fairly long and does not remain wet for at least a few days, very few strikes will occur. However, if some areas of wool stay wet from either rain, heavy dews, or urine they attract the green fly and she soon lays her eggs.

CONSIDERATIONS IN FORECASTING.

In making a forecast about blowfly strike in your flock, you have to consider the following.

(1) How Attractive are Your Sheep to Blowflies?

Crutch strike and body strike should each be considered singly. If you answer "yes" to at least one in each of the following pairs of questions there is a fair chance crutch strike won't occur in your sheep now or in the near future.

(*a*) Have my sheep been treated with the Mules and tail strip operations and did each ewe have its tail cut level with the tip of the vulva?

or

Were my ewes crutched less than six weeks ago?

(*b*) Are my ewes free from damp urine stain around the breech?

or

Were my ewes jetted or spretted with arsenic less than six weeks ago?

If you can answer "yes" to at least one in each of the following pairs of questions there is a fair chance your sheep will not be struck on the body just now.

(*a*) Have the fleeces on my sheep been free from continuous wet such as rain, heavy dews or flood waters?

or

Are my sheep carrying less than three months' wool?

(*b*) Are my sheep free from any discolouration of the wool on the back, sides and shoulders?

or

Have my sheep been sprayed over the back, sides and shoulders during the last two weeks with a 1 per cent. solution of DDT?

(2) Is the Blowfly Population Likely to Incease in the Near Future?

If you answer "yes" to at least one of the questions in each of the following pairs there are fair chances it will.

(*a*) Is it the late summer and autumn season?

or

Is it the spring and early summer season?

(*b*) Were there useful rains during the 4-6 weeks preceding to-day's date?

or

Is the weather at present warm and humid?

(*c*) Were blowflies active at some time during the previous six months?

or

Has the weather been warm and moist since the last fly-wave?

(*d*) Are a few sheep in the district being struck now?

or

Is the feed green and lush?

Further Information.

A more detailed discussion of the sheep blowfly problem in Queensland is given in Advisory Leaflets Nos. 27, 29 and 31, which are available to woolgrowers free of charge on application.

MARKETING

Movements in the Wholesale Price of Tomatoes—Brisbane, 1948-1953.

PREPARED BY OFFICERS OF THE DIVISION OF MARKETING.

THIS analysis of tomato prices on the Brisbane market since January 1948 represents an endeavour to isolate and interpret the seasonal pattern and to elucidate the general trend over the last five years.

GENERAL REMARKS ON PRODUCTION AND MARKETING.

It is considered essential to make some preliminary reference to the actual price data used as well as to certain aspects of the production and marketing of tomatoes as they impinge on prices in Queensland.

Prices Information Collected.

The price data which have been subjected to examination consist of average weekly and monthly prices calculated from the records of daily price ranges obtained by the Market Price Reporting Section of the Division of Marketing.

For the most part these averages are representative of the general quality available. However, there are short periods when the tail-end of a crop from one district overlaps supplies of choice new season's tomatoes from another district, resulting in two distinct levels of prices. Under these conditions, it is obvious that no single average could adequately represent the full range of prices and quality then available. Nevertheless, as these periods are merely transitional in character it seems reasonable to use a calculated average which falls between the two levels as indicative of the movement of prices generally.

Production.

Queensland production of tomatoes averaged 1,308,260 half-bushel cases per year over the five years 1947-48 to 1951-52, and during the last four of those years the annual acreage remained remarkably constant at between 5,500 and 6,000 acres. This is reflected in the quantity of tomatoes produced, which varied between 1,230,000 and 1,286,000 half-bushel cases from 1948-49 to 1951-52 compared with 1,471,000 cases from 6,759 acres in 1947-48.

Reference to Tables 1 and 2 shows that the main producing districts are located within the statistical divisions of Moreton, Townsville and Downs, which together account for about 88% of the total production.

Marketing.

Queensland is a substantial net exporter of tomatoes. Approximately 44%, or nearly half of the State's total annual production, finds its way to interstate markets. The principal outlet for the remainder of commercial production is the Brisbane Wholesale Market.

TABLE 1.

TOMATOES.

AREA AND PRODUCTION IN MAIN STATISTICAL DIVISIONS.

(Average 1947–48 to 1951–52.)

(Source—Queensland Government Statistician.)

Statistical Division.	Area.		Production.	
	Acres.	Per Cent.	Half-bushel Cases.	Per cent.
Townsville	1,735	29·3	388,283	29·7
Rockhampton	499	8·4	84,523	6·5
Moreton	1,671	28·3	480,545	36·7
Downs	1,651	27·9	287,095	22·0
Rest of State	356	6·1	67,814	5·1
Total State ..	5,912	100·0	1,308,260	100·0

TABLE 2.

TOMATOES—QUEENSLAND.

AREA AND PRODUCTION IN MAIN STATISTICAL DIVISIONS.

(Source—Queensland Government Statistician.)

Statistical Division.	—	1947–48.	1948–49.	1949–50.	1950–51.	1951-52.
Townsville ..	Acres	2,017	1,564	1,602	1,807	1,684
	½ Bush.	507,514	356,090	389,036	277,648	411,126
Rockhampton	Acres	679	448	453	570	344
	½ Bush.	107,833	73,208	69,784	113,584	58,204
Moreton ..	Acres.	1,792	1,476	1,567	1,783	1,737
	½ Bush.	488,420	405,512	466,286	504,230	538,276
Downs ..	Acres	1,776	1,866	1,649	1,573	1,390
	½ Bush.	288,022	387,836	301,708	260,042	197,868
Rest of State	Acres	495	278	318	336	356
	½ Bush.	79,640	48,822	59,678	74,324	76,608
Total State ..	Acres	6,759	5,632	5,589	6,069	5,511
	½ Bush.	1,471,429	1,271,468	1,286,492	1,229,828	1,282,082

Import and export of tomatoes takes place throughout the year, but the volume of interstate exports from Queensland is considerably in excess of imports. Exports during 1952 reached a total of 809,004 cases, compared with imports of only 61,284 cases.

The greater percentage of exports is "on consignment" from Queensland growers to agents in New South Wales, and the main reason for this is that from May to September Bowen producers provide the Sydney market with a fairly high percentage of its total supplies. For Bowen growers, the Brisbane market is of only secondary importance. In addition to these northern consignments, the southern markets also draw supplies direct from many growers in the Central and Moreton districts of Queensland, usually during September, October and November. However, in the main, the principal market for Central and South Queensland crops is Brisbane.

Over the last four years, the volume of interstate imports has increased greatly, and during 1952 a total of 61,284 cases was imported, compared with 21,589 cases in the previous year and only 5,447 cases in

1949. This has resulted mainly from an increasing tendency towards heavy supplies on the Sydney market in recent years, particularly during the months from October to April, with a consequent change in relative price levels in favour of Brisbane.

The frequent disparities in price levels between Brisbane and Sydney have encouraged an increase in the number of interstate operators and an intensification of their activities. It is significant that with the exception of direct consignments from northern New South Wales growers, the greater part of the inward movement of tomatoes from southern States can be classed as speculatory. As the Brisbane market is conveniently situated in relation to producing districts in northern New South Wales, it naturally attracts spring and early summer consignments direct from growers in districts located between the Tweed River and Coff's Harbour.

A statistical summary of interstate imports and exports of tomatoes since 1949 is presented in Table 3.

TABLE 3.

INTERSTATE IMPORTS AND EXPORTS OF TOMATOES.

(Source—Department of Agriculture and Stock, Queensland.)

Period.	—	1949.	1950.	1951.	1952.
January–March	Imports	637	9,646	4,812	31,985
	Exports	90,184	44,116	31,794	7,809
April–June	Imports	2,477	244	1,098	4,287
	Exports	122,468	139,241	185,985	175,795
July–September	Imports	384	1,539	888	7,288
	Exports	224,828	124,770	297,093	500,347
October–December ..	Imports	1,949	4,591	14,791	17,724
	Exports	104,243	267,752	120,112	125,053
January–December ..	Imports	5,447	16,020	21,589	61,284
	Exports	541,723	575,879	634,984	809,004

SEASONAL PATTERN OF PRICES.

Tomato prices exhibit a seasonal pattern which is neither precise nor regular. The course of prices is nevertheless confined between broad but fairly definite limits.

This pattern is illustrated in Plate 1, on which comment is made at a later stage.

Both the supply of and the demand for tomatoes so far as Queensland alone is concerned are fairly stable from year to year and each exhibits a fairly regular seasonal pattern of its own. However, frequent periodic disturbances emanating from southern markets cause considerable distortion. The effect of these disturbances on prices is such as to make any precise representation of the seasonal pattern impossible unless their influence is measured and eliminated. However, such treatment is undesirable in this analysis since the resultant pattern would be unrealistic.

Supply Factors.

The main feature of the supply of tomatoes to the Brisbane market is that peak supplies from the various districts arrive at different times of the year.

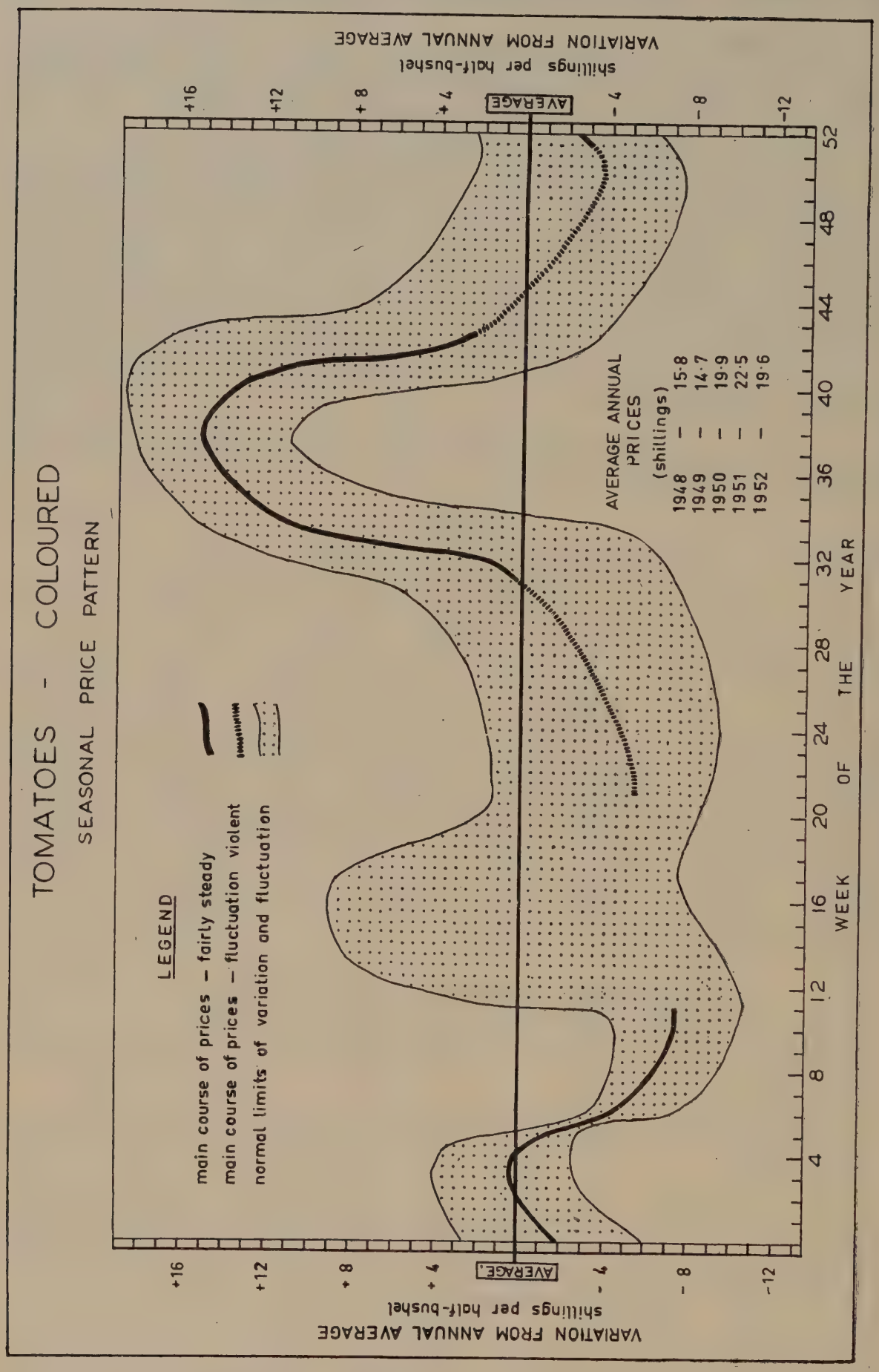


Plate 1. **Seasonal Price Pattern of Coloured Tomatoes.**

From mid-January to mid-March the market is usually well supplied from the Stanthorpe district. These supplies dwindle rapidly with the onset of frost, but during the autumn adequate stocks are generally available from areas near Brisbane. By May, small quantities begin to arrive from North Queensland districts, and it is quite common during May and June to find most Queensland coastal areas represented.

Local growers in areas close to Brisbane can usually produce satisfactory crops from March to December, but their midwinter production is generally curtailed because competition from northern crops, which reach a peak in July, sometimes causes prices to fall to a fairly low level. Northern consignments tend to decline somewhat in quality during August, and quantities fall off sharply in September. However, moderate quantities from the spring crop in Central and South Queensland coastal districts are harvested from August to early October and these are the main supplies available during that period. A heavy local crop is then the dominating influence until about Christmas.

Demand Factors.

Tomatoes enjoy a good measure of popularity throughout the year, but their use is more widespread during the summer months, so the Queensland demand is essentially seasonal in character. Some modification of this basic pattern is caused by the fact that producing districts throughout the State are widely separated, and climatic differences between producing areas cause demand on the Brisbane market by country centres to vary with the availability of local supplies in those areas. Furthermore, the volume of demand for tomatoes on the Brisbane market is at times greatly increased by requests from interstate sources, with the result that the inherent seasonality of Queensland demand is effectively disrupted.

Nevertheless, the forces which obscure the basic seasonal pattern are themselves regular in occurrence, if not in intensity, and display a measure of seasonality.

Generally there is a good demand for tomatoes on the Brisbane market during January, February and March, particularly from northern towns. This is because the normal seasonal enquiry is accentuated by the fact that the main source of supply is the relatively small Stanthorpe district located in the southernmost part of the State, and only very light local supplies are available in other districts.

Towards the end of March a slight reduction in demand is experienced as near-Metropolitan districts come into production, and dependence of these heavily populated areas on the Brisbane market is reduced. These conditions usually obtain throughout April. Similarly, a further reduction can be expected in May with the start of the new season's crop in the north, but this is invariably offset by speculative enquiry from interstate sources.

Southern demand is usually greatest during June, but weather conditions in New South Wales during July often have an adverse effect upon tomato sales in the Sydney Markets and this is followed by a similar reaction in Brisbane. However, interstate enquiries remain a dominant influence until late-October, when fresh supplies from New South Wales districts cause a rapid decline in prices.

The warm weather during November and December might be expected to favour tomato sales, but generally speaking demand on the Brisbane market at that time is only moderate, probably because there is some production in most districts which is available for local consumption.

Description of Seasonal Price Pattern.

The seasonal pattern of tomato prices resulting from the interaction of the factors outlined above is necessarily broad and at times indefinite.

A central tendency or normal course of prices is apparent during most of the year, but it will be seen that prices vary about this course between fairly well established limits. Consequently the general direction in which prices move and the normal range of variations must be taken together when considering the overall seasonal pattern. It has been found that weekly fluctuations and seasonal changes in the level of prices tend to show a more or less fixed monetary margin above or below the annual average at different periods of the year rather than a percentage relationship to that average.

Both the general course of prices and the normal limits of fluctuation are illustrated in Plate 1. However, when referring to this chart it should be remembered that there are occasions when exceptionally violent disturbances cause prices to move beyond the limits shown.

TABLE 4.

TOMATOES—COLOURED.

MONTHLY AVERAGE PRICES—BRISBANE WHOLESALE MARKETS.

(Source—Division of Marketing.)

Month.	Shillings per Half-bushel Case.					
	1948.	1949.	1950.	1951.	1952.	1953.
January ..	16·5	15·4	16·1	11·5	28·6	21·0
February ..	11·5	4·4	13·9	11·1	34·7	10·9
March ..	9·1	7·3	10·4	25·4	22·8	11·2
April ..	8·3	19·4	17·9	19·8	10·0	14·8
May	12·6	15·3	13·9	13·3	9·1	28·5
June	16·0	9·8	13·3	11·5	11·6	..
July	20·0	10·4	17·2	18·6	12·6	..
August ..	28·5	17·8	36·5	19·2	15·6	..
September ..	27·4	26·4	39·2	36·4	16·2	..
October ..	17·2	18·9	29·0	34·3	24·5	..
November ..	12·5	15·8	17·8	32·2	23·3	..
December ..	10·0	15·5	13·4	34·6	23·5	..

TABLE 5.

TOMATOES—GREEN.

MONTHLY AVERAGE PRICES—BRISBANE WHOLESALE MARKETS.

(Source—Division of Marketing.)

Month.	Shillings per Half-bushel Case.					
	1948.	1949.	1950.	1951.	1952.	1953.
January ..	10·9	8·8	12·4	8·1	23·0	14·3
February ..	7·5	4·4	8·4	6·8	32·5	8·5
March ..	6·3	5·8	7·6	20·1	12·5	8·1
April ..	6·2	12·7	12·3	11·7	8·2	10·4
May	8·8	10·9	11·7	9·5	6·6	18·8
June	11·4	7·4	10·6	8·7	8·5	..
July	13·2	7·8	11·5	13·0	9·0	..
August ..	23·3	12·4	31·2	13·7	14·4	..
September ..	22·5	..	32·2	..	14·0	..
October ..	17·2	16·5	23·1	32·7	20·7	..
November ..	10·7	12·9	17·2	28·8	21·8	..
December ..	9·5	11·8	11·4	27·0	19·2	..

The seasonal pattern consists of one period (March-May) when prices show no tendency whatsoever to follow a definite course; two periods of relatively smooth movement (January-March and August-October) and two periods (June-July and November-December) which are marked by a fair degree of fluctuation about the central course.

Taken in chronological sequence, the first period extending from January to mid-March is one in which prices follow a fairly smooth course within the limits shown in Plate 1. Prices for coloured tomatoes tend to firm in the early part of this period as consignments from near-Metropolitan districts decline, whilst most of the receivals from Stanthorpe are in green condition. However, increased quantities early in February cause prices to drop. A further fall is usually experienced over the latter part of the period and this is attributable mainly to a decline in quality following seasonal rains.

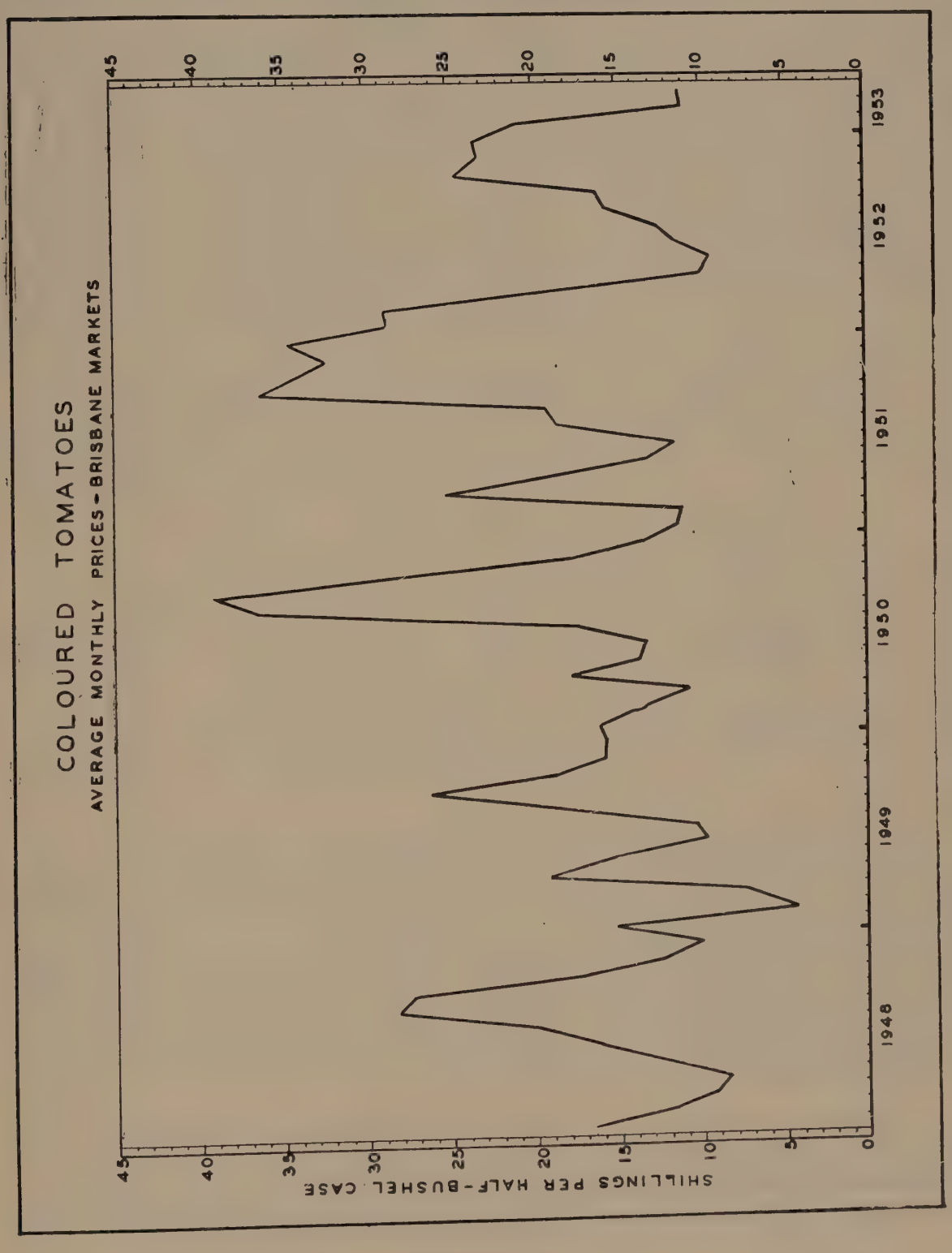


Plate 2. Average Monthly Prices for Coloured Tomatoes.

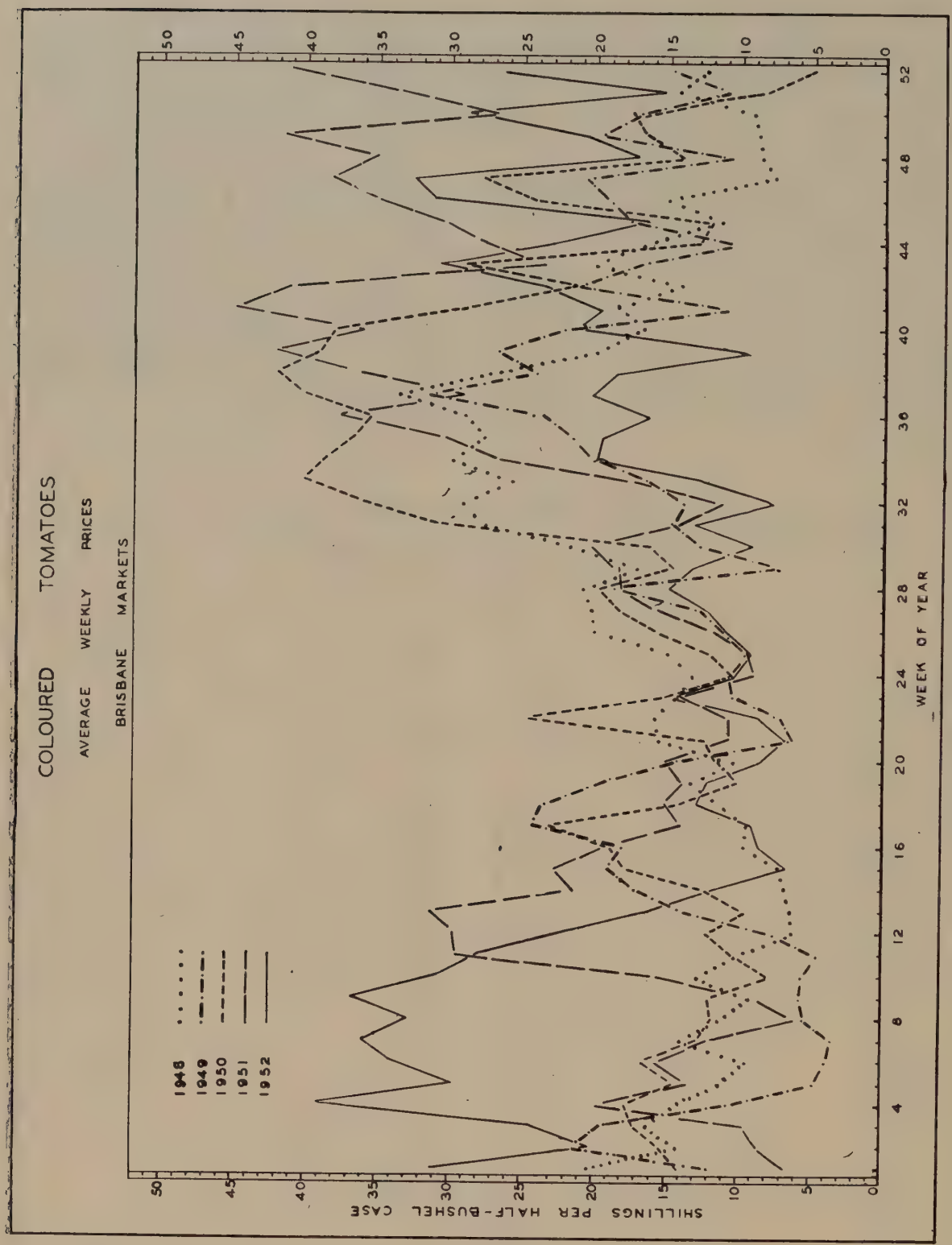


Plate 3. **Average Weekly Prices for Coloured Tomatoes.**

The second period usually extends from the 11th to the 21st week of the year (mid-March to the end of May). This is the one period for which no central tendency of prices is apparent and the range over which prices can fluctuate is most extensive. Reference to Plate 1 will show that the normal limits of this range are approximately nine shillings above and eight shillings below the average price for the year. The instability characteristic of this period is mainly produced by unseasonal extensions of the harvesting period in the Stanthorpe district or the early arrival of tomatoes from Bowen and other northern districts.

The third period takes in the months of June and July, during which prices tend to fluctuate sharply whilst at the same time moving in a general upward direction. At this time of the year, conditions in the Sydney market exert a dominating influence on tomato prices in the

Brisbane wholesale markets. If prices tend to fall in Sydney, Brisbane usually suffers a decline in interstate purchases together with increased receivals from Bowen, and these factors, in conjunction with the normal seasonal limitations of *per capita* consumption, cause a sharp drop in values. Conversely, a tendency for prices to rise in Sydney also reacts quickly on Brisbane prices, forcing a fairly sharp rise.

By contrast, the next period (August-September-October) is relatively free from sudden fluctuations. The main feature of prices is a steep upward movement which reaches a peak somewhere around the 38th week of the year. The initial reason for this upswing is a falling-off in supplies and it is maintained and even accentuated by an improvement in demand with the advent of warmer weather. However, during October, increasing supplies from the new spring crops of the coastal areas south of Rockhampton usually precipitate a fall in values. Nevertheless, average realisations for tomatoes over the whole of this period are, in normal times, at least twice as high as those obtaining at other periods of the year.

Fairly wide fluctuations about a falling price level are the main attributes of the tomato market during the remaining period of November-December. Supplies are moderately heavy at first and diminishing southern outlets constitute the main depressing influence. During December the local crop tails off, and as the early deliveries from Stanthorpe are in very green condition some improvement in prices for the coloured tomatoes available from south-eastern districts is usually registered over the last week or so of the year.

It seems reasonably certain that, although the pattern presented in Plate 1 shows fairly wide limits, tomatoes marketed consistently in one period of the year for a number of years should return an average which would tend to vary from the annual average to the extent shown by the heavy line in Plate 1.

Variations from the Seasonal Pattern.

From the foregoing it is evident that the nature of tomato marketing and production is such that the normal price pattern is one of variation within limits. However, at times episodic disturbances occur which take prices outside the normal variations. These disturbances invariably follow either a complete crop failure in a particular district when it has a virtual monopoly of supply or a combination of unusually heavy crops with unseasonal overlapping of harvesting periods in different districts.

A typical example of such extreme variation was provided by the behaviour of prices in February, 1952. Early plantings in the Stanthorpe district were curtailed as a result of abnormally dry weather conditions, with the result that consignments to the Brisbane market during February were extremely light, and this, coupled with an unusually heavy seasonal demand, caused prices to rise well beyond the normal limits. Prices as high as 45 shillings per half-bushel case were recorded, whilst the calculated average monthly price covering all sales was 34·75 shillings, compared with a normal mean for February of about 10 shillings.

An example of extremely low prices was provided in May, 1952. Good rains toward the end of January enabled additional plantings plus a measure of replanting in the Stanthorpe district and a heavy late season crop was harvested. At the same time, mild weather in the late

summer and autumn also ensured crops in most of the other producing areas of both Queensland and New South Wales. This resulted in very heavy supplies arriving on the Brisbane market during the early part of May at a time when demand was abnormally weak, and, as a consequence, prices during that period were extremely low. The average price for the month was only 9·1 shillings per half-bushel case, compared with a normal mean of 13·75 shillings.

TREND.

An analysis of tomato prices covering the period from July 1947 to December 1952 reveals an upward trend in prices up to the end of 1951. This resulted in an increase in basic values of about 2·2 shillings per half-bushel case per annum.

Subsequent to the end of 1951, any possible trend has been so masked by pronounced episodic disturbances which have largely coincided with somewhat changed economic conditions that it is impossible to determine whether the previous trend is continuing or a new short-term trend has taken its place.

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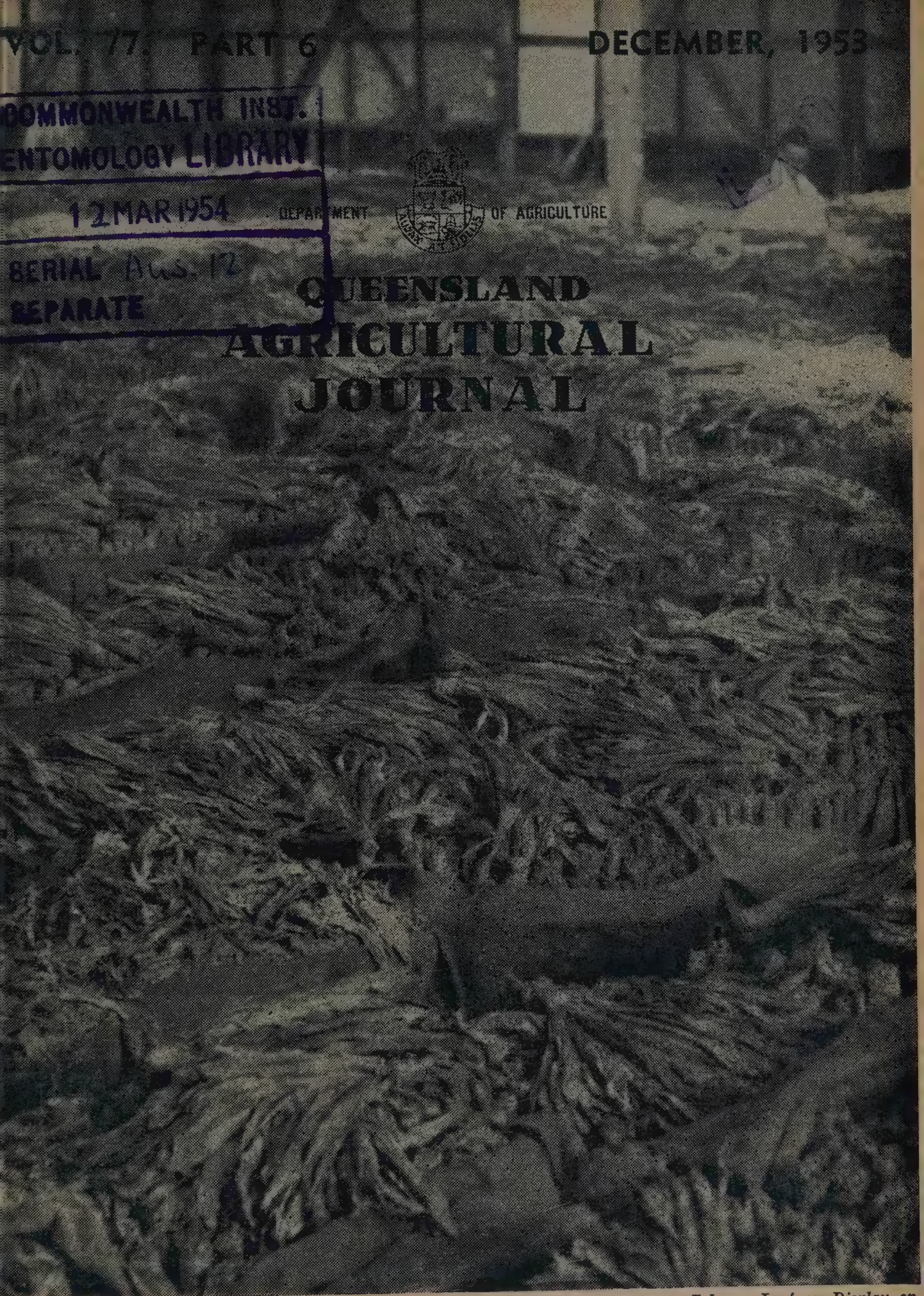
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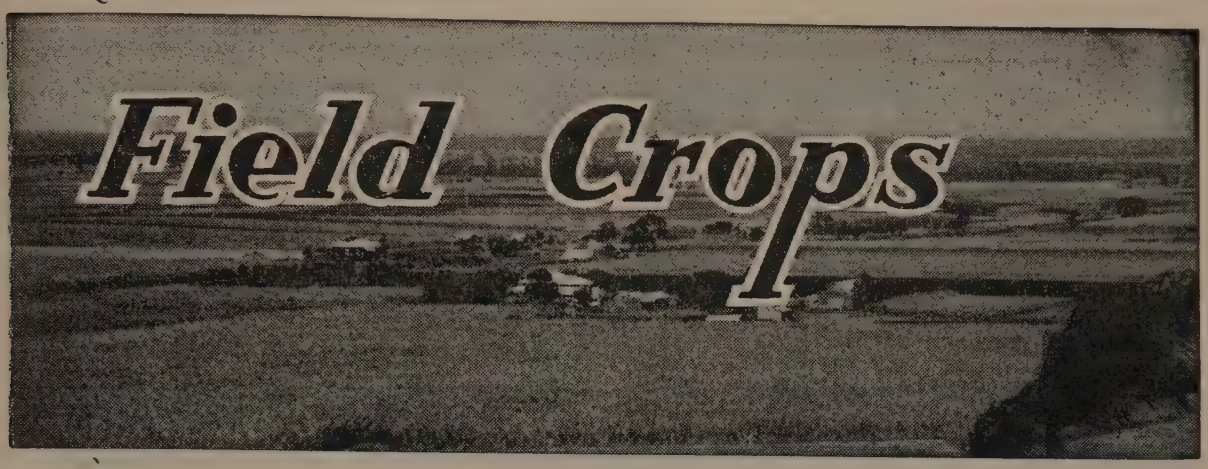
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Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
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J. L. GROOM (Agronomist), and E. C. DARLEY (formerly Assistant Agronomist), Agriculture Branch.

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HAYMAKING.

Lucerne must be cut at the correct stage and properly cured if a high-quality hay, containing a high percentage of leaf of good colour, is to be obtained. Early cutting will give a hay of slightly better quality, though curing at this stage may be more difficult. However, yields will be reduced and the life of the stand shortened by this practice.



Plate 1.

A Vigorous Lucerne Stand in the Lockyer Valley.

The correct stage for cutting is when the plants are about one-tenth in bloom. In those seasons of the year when the basal shoots appear and elongate before flowering, lucerne should be cut immediately these shoots commence growth.

Delayed cutting gives inferior hay due to the increase in fibre content and to the greater loss of leaf. It may also mean partial lodging of the crop and a lower yield at the next cutting because of damage to the basal shoots.

The advent of modern machinery has reduced very considerably the time required for haymaking, but it is still desirable to be reasonably sure of a period of fine weather before commencing the job. Cutting with a horse mower, or with the speedier tractor-operated power mower, may be started as early in the day as possible, though a start should not be made until the dew has evaporated.



Plate 2.

Raking Lucerne.

The crop should be allowed to wilt in the swath as cut by the mower and then raked into windrows (Plates 2 and 3) for cocking. Where the hay is to be cured in the windrows without cocking, a side-delivery rake (Plate 5) should be used to construct the windrow, as the dump rake commonly used tends to compact the plant material unevenly, preventing uniform curing.

A recent development consisting of a pick-up head and roller crusher attached to the mower crushes the mown stems and evens up the rate of moisture loss from the stems and leaves, permitting much more rapid and uniform curing. In good curing weather this device often permits the cutting, curing and baling of the hay on the same day.

Where the hay is to be cocked it should be left in the windrows for a few hours after raking. The cocks should be tall and narrow and built to

shed water should rain occur (Plate 4). If the lucerne is too moist when cocked it may be necessary to loosen the cocks with a fork during the curing process. Curing takes from two to four days, according to the weather and to the condition of the hay at the time of cocking.



Plate 3.

Lucerne in Windrows.



Plate 4.

Lucerne in Cocks.

With the reduction in the availability of seasonal labour, the manual labour previously required for carting and stacking is gradually being replaced by mechanical methods. However, where sweeps, loaders or balers are not available, hay may have to be forked onto trucks for cartage from the paddock. Where the hay is being stacked at the side of the paddock, a sweep or a buck-rake operated by horses or a tractor can be used to transport the hay quickly from the paddock to the stack site.

Hay is ready for stacking if no moisture can be extracted when a small handful is twisted in the hands. The bark should be difficult to peel off, and it should not feel cool to the touch.

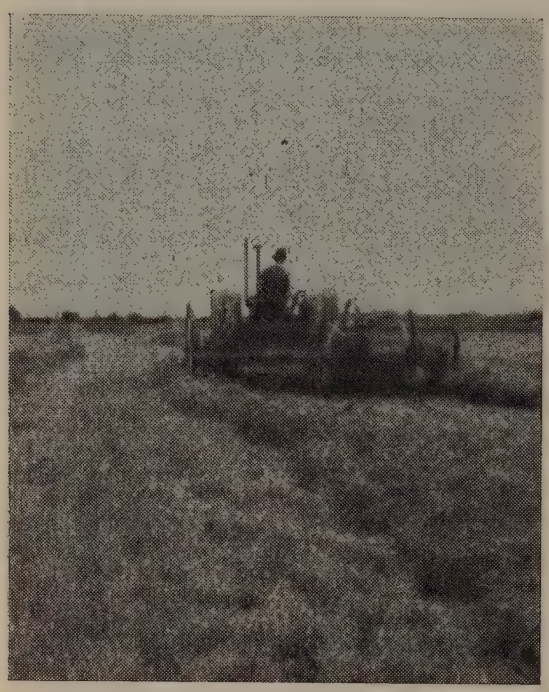


Plate 5.

Windrowing Lucerne With a Side Delivery Rake.



Plate 6.

A Pick-up Baler Working on the Windrows Shown in Plate 5.

More commonly to-day, the cocking process is dispensed with, the hay being raked with a side-delivery rake and cured to a safe moisture level in the windrow, and baled in the field, using either a hay sweep and stationary baler, or a pick-up baler (Plates 6 and 7). This method not only simplifies operations, but compresses the hay, enabling more hay to be stored in the same space and also generally resulting in less loss of leaf through the reduction in handling. The recently developed rolled-bale machine may be more efficient in retaining leaf than the rectangular bale, piston-press machines (Plate 8).

In many areas of Queensland, climatic conditions produce over-quick curing and excessive drying. This has influenced farmers to work on the crop only till noon, and again in the late afternoon. At these times the crop is generally tougher, and loss of leaf is reduced to a minimum.

Yields of lucerne hay vary considerably with growing conditions. By the use of irrigation, up to eight cuttings per year can be obtained and some cuts may yield as much as two tons of hay per acre. In the Lockyer Valley, five to six tons of hay per acre is the average yield per year from irrigated lucerne.

Up to three mowings may be obtained in good seasons from lucerne grown with rainfall only, with yields of $1\frac{1}{2}$–2 tons of hay per acre per year.



Plate 7.

An Automatic Hay Baling Machine That Produces Rectangular Bales.



Plate 8.

Portion of a Stack of Rolled Bales of Lucerne.

LUCERNE SILAGE.

In addition to being the outstanding hay crop, lucerne can be used to make excellent silage. The silage is superior in stock food value to good hay. Silage is free from fire hazard, and requires less storage space than is the case with hay. By conserving lucerne, pastures and other crops as silage in good seasons, Queensland farmers could do a great deal towards solving their problems of feeding stock in drought periods.

In the production of any silage, the maturity and chemical composition of the crop, the moisture content, the rapidity and completeness of the exclusion of air from the silo, and air temperatures all influence the type of fermentation and thus the quality of the silage. Few Queensland farmers conserve lucerne as silage, but it is considered that the practice is worthy of wider application.

Lucerne for silage should be cut at an early bloom stage (one-tenth to one-fourth in bloom). Grasses should be cut after the heads have emerged but before the plants have started to bloom. Lucerne-grass mixtures should be cut at a stage best suited to the predominant crop in the mixture.

The moisture content of the crop at the time of ensiling is most important in determining the type of fermentation, the amount of food losses, and the quality of the silage. A high moisture content causes high losses of the conserved material. When the moisture content is too low, moulding and spoilage ensue. Silos should be well drained to prevent the silage becoming waterlogged. Most crops at the stage of growth when cut for silage have moisture contents ranging from 74% to 80%, though during prolonged dry spells crop moisture may be down to 70%.

With crops of high carbohydrate but low protein content, good silage can be made at a high moisture content, provided all operations are carried out carefully. However, with high-protein crops such as lucerne, or grasses cut before heading, a high moisture level will result in poor silage with a strong offensive odour.

A mild silage of good quality can be produced from crops with a high protein content by simply wilting them in the field to a moisture content below 68%, or, when weather conditions prevent paddock wilting, by adding up to 15% dry hay as the crop goes through the silage cutter.

The best silage is made when the moisture content is between 60% and 68%.

Research in the U.S.A. has shown that preservatives may be fed through the ensilage cutter with unwilted grass or lucerne to improve the feeding quality of the resultant silage, molasses, ground wheat or maize being satisfactory for this purpose. They are most useful with crops of high moisture and high protein contents, but have little use with low-protein or low-moisture crops, often doing little more than increasing the palatability of the silage.

Molasses produces a more desirable type of fermentation and assists in raising the acidity of the silage, which is desirable also. Dry grains lower the moisture content a little, and reduce seepage from high-moisture crops.

The use of preservatives is seldom necessary when the crop has been wilted to below 68% moisture. The acceptable stage of wilting is that at which the leaves and stems have become limp, and when the stems can be readily twisted in two, the broken ends being dark and moist, but not juicy

TABLE 3.

Suggested Preservatives for Use with Lucerne and Grass Silage.

Crop for Silage.	Molasses.	Ground Corn or Wheat.	Corn and Cob Meal.
	%	%	%
Green Lucerne	4	7	9
Wilted Lucerne	3	4·5	7
Green Lucerne and Grass, Before Heading ..	4	7	9
Wilted Lucerne and Grass, Before Heading ..	3	4·5	7
Green Lucerne and Grass, After Heading ..	3	4	4
Wilted Lucerne and Grass, After Heading ..	None	None	None
Green Grasses, Before Heading	3	7	9
Wilted Grasses, Before Heading	2	4·5	4·5
Green Grasses, After Heading	2	4·5	3·3
Wilted Grasses, After Heading	None	None	None

(Extracted from "Grass", U.S.D.A. Yearbook of Agriculture, 1948.)

Grass or lucerne for silage should be cut short to give better consolidation and exclusion of air. The silage cutter should be set to cut lengths of $\frac{1}{4}$ in. to $\frac{3}{8}$ in. A long cut will prevent tight packing and lead to mould development.

High temperatures are undesirable in silage; they can be prevented by rapid filling, even spreading and good consolidation. Unwilted material should be used for the top layer of the silo to give extra weight and pressure. The top of the ensiled material should be covered with a reinforced waterproof paper, well lapped at the seams and against the walls, and covered with an effective layer of fresh green crop or other material.

LIME PAINT FOR JUTE SHACKS.

Dissolve 12 lb. of common salt and 1 lb. of powdered alum in about four gallons of hot water. Add 1 quart of molasses. Make a thick cream by thoroughly mixing 50 lb. of lime with about seven gallons of hot water. Add the clear liquid to the lime cream, stirring vigorously. The desired consistency should be somewhat thicker than that of ordinary paint, so that it wil adhere without running, when applied.

It is essential to dampen the hessian almost to the point of saturation before applying the paint.

This recipe should make sufficient paint to give a shack of 105 square yards outside wall area one good thick coat.

FORMULA FOR CEMENTING BAGS.

A composition using cement and intended for painting over bags stretched tightly and securely tacked to a framework of timber can be prepared as follows:—

Water	1¼ gallons	Salt	1 lb.
Cement	12 lb.	Alum	½ lb.
Lime	2 lb.		

Sieve the salt and lime together through a fine sieve, add this to the water and follow with the cement, stirring thoroughly. Finally add the alum. The bags should be thoroughly wet and the mixture applied without delay, using a fairly stiff brush, first on the outside then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside.

When this sets the bags will be quite hard and stiff, something like plaster board.

Summer-Growing Annual Hay Crops Suitable For Coastal South-Eastern Queensland.

A. HEGARTY, Adviser in Agriculture, Agriculture Branch.

THE dry spring and early summer period which normally occurs each year results in a serious decline in dairy production. When these conditions extend and reach drought proportions, losses of producing animals are not unlikely. Farmers should therefore take precautions to make adequate provision for conserving fodder in the form of hay, grain or silage reserves to tide over this period.



Plate 1.

A Good Stand of Poona Pea/White Panicum Mixture Suitable for Haymaking.

A wide range of soil types is represented in coastal south-eastern Queensland, but the area is not well endowed with land of a convenient topography suitable for lucerne growing. Where soil and drainage are favourable, lucerne is recommended; otherwise for hay purposes in these coastal districts it is essential to give attention to annual summer-growing crops.

Annual summer-growing hay crops are not costly to produce and store. Their handling is well within the scope of the average farmer and they should therefore be part of general farming practice, particularly where livestock are raised.

Hay reserves are essential in most years for the months July to October, inclusive. Each milking cow requires a supplement to pasturage of at least 20 lb. of good hay per day for maintenance and production. For a 120-day feeding period, it is thus necessary to make provision for 2,400 lb. of hay for each animal as a drought hay reserve.

On average farms in the Gympie district, for example, approximately 30 cows would be in production over the critical period of acute pasture shortage. The hay reserve required would be 30–40 tons. In drought years such as 1951, a minimum reserve of at least 1½ tons of hay per milking cow would be needed, equivalent to 45 tons for a herd of 30 cows. In the latter case, the hay from about 10 acres of a good Sudan grass crop or 20 acres of a Poona pea/white panicum mixture would be needed.



Plate 2.

A Crop of White Panicum Just Prior to Seeding.

It is appreciated that there are a number of hillside farms on which there is little if any cultivable land. Nevertheless, even a small area can produce some hay to be set aside as a drought reserve. On the other hand, there are many farmers with sufficient arable land to produce sufficient hay for adequate drought reserves.

Favourable haymaking weather is usually present during the months of December and January, and often in the autumn. Poona pea/white panicum mixtures (Plate 1), white panicum (Plates 2 and 3) or Japanese millet and other annual millets, and Sudan grass have all been proved to

be suitable haymaking crops in the coastal districts. The careful farmer who has paid attention to his fodder reserves, will find hay from these crops to be of great value during dry periods and droughts.

Soil fertility is a major factor influencing the bulk of crop which can be produced. Naturally the heaviest yields can be expected from fertile land, but even the poorer soils can be made to produce successful crops with the aid of fertilizer and judicious management.



Plate 3.

Mowing an Excellent Crop of White Panicum for Hay.

Poona Pea/White Panicum Mixture.

The mixture of Poona pea and white panicum has given excellent results and is becoming increasingly popular. A sowing mixture of 20 lb. of Poona pea and 10 lb. of white panicum per acre can be used, broadcast and harrowed in with the first early summer storm rains. Experience may show that these seeding rates can be increased profitably in some instances. In all cases it is advisable to treat the Poona pea seed, before sowing, with the appropriate bacterial inoculum, which can be obtained free of charge on application to the Department of Agriculture and Stock, Brisbane.

Observations have also shown the value of using a phosphate-rich fertilizer to stimulate growth of legumes such as Poona pea. Most successful growers now use a fertilizer mixture containing nitrogen and phosphate, or a blood, bone and superphosphate mixture at $1\frac{1}{2}$–2 cwt. per acre.

The crop should be cut for hay when the seed of the white panicum is in the milky stage and the Poona pea plants are commencing to flower. Haymaking is carried out in the conventional manner, though a longer period of drying in the windrow is necessary because of the thick nature of the Poona pea stems. Usually 10–14 days is required to complete drying, depending on weather conditions.

Yields of air-dry hay vary from 20 cwt. to 35 cwt. per acre, with good crops up to 2¼ tons of hay per acre.

A well made sample of this hay is very attractive and very palatable to stock. In feeding trials, dairy cattle have milked equally well on this hay as on fair lucerne hay. Based on feeding value and production, much greater use could be made of this hay crop, particularly where lucerne cannot be grown satisfactorily. The cost of production is low and the hay has been found to keep well under stack and shed conditions.

White Panicum, Japanese Millet, and Other Millets.

Grown as a straight hay crop, white panicum and Japanese millet have been much favoured by farmers and little interest has been shown in other varieties of this valuable crop. As with the previous mixture, the plantings are usually made on soils where lucerne cannot be grown successfully.

Broadcast sowings are made at the rate of 20 lb. per acre and are usually followed with a broadcast of fertilizer. The area is then thoroughly disc harrowed. Growth is generally rapid. The Japanese millet will reach the hay stage in 6–8 weeks from planting, with white panicum being 2–3 weeks later in maturity.

Cutting for hay is made as the seed is in the milky stage. The crop is hayed and stored in the conventional manner. The yield of air-dry hay per acre varies from 20 cwt. to 30 cwt., with good crops yielding in excess of 2 tons per acre. The time required to cure the hay properly varies from 8 days to 10 days.

Due to the lower cost of seed and less time and labour involved in harvesting, straight panicum hay is cheaper to make than Poona pea/white panicum hay. However, because of the absence of a protein-rich component such as the legume Poona pea, the protein value per ton of panicum hay is lower than that of the mixture.

General observations in the field indicate that the Poona pea/white panicum mixture is the better proposition. Not only does it consistently produce a higher quality hay at only a slightly increased cost per ton, but the crop, because of the legume component, is more likely to maintain soil fertility. It is therefore a better rotation crop than white panicum alone.

Sudan Grass.

Sudan grass has proved to be a very valuable bulk fodder for hay purposes. The crop is grown widely for grazing in coastal districts, but a number of farmers also conserve a quantity of the crop as hay each year. Farmers fortunate enough to have Sudan grass hay in hand during the 1951 drought found it extremely useful as maintenance roughage. The hay is much coarser and less palatable than Poona pea/white panicum hay and the feeding value is considerably lower. The high yield of hay per acre, however, is a distinct advantage.

Sowings are commonly made in early summer at the rate of 15 lb. per acre when broadcast. In general, fertilizer is not used with this crop, as it will give fair yields under harsher conditions than most other crops. It is a comparatively long-season crop, requiring approximately 3–3½ months before reaching the hay stage. Weather conditions affect crop yields to a large degree. Very heavy yields have been recorded under favourable conditions, but not infrequently only poor yields have been obtained.

Haying is carried out along standard lines, but due to the thick stalks, constant turning in the field is necessary to maintain even drying out and prevent moulding on the bottom of the windrow.

It is estimated that it takes up to a fortnight to cure a heavy crop of Sudan grass satisfactorily. In the wetter parts of the district, this extended curing period may present a weather hazard.

Yields of air-dry hay vary from 2 tons to 3 tons per acre from the initial cut, with the possibility of an additional cut of 1–2 tons from ratoon growth.

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Representing a total of .....
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SIZE OF SAMPLE

Barley	8 oz.	Oats	8 oz.
Beans	8 oz.	Peas	8 oz.
Grasses	2 oz.	Sorghum	4 oz
Lucerne	4 oz.	Sudan	4 oz.
Millets	4 oz.	Wheat	8 oz.

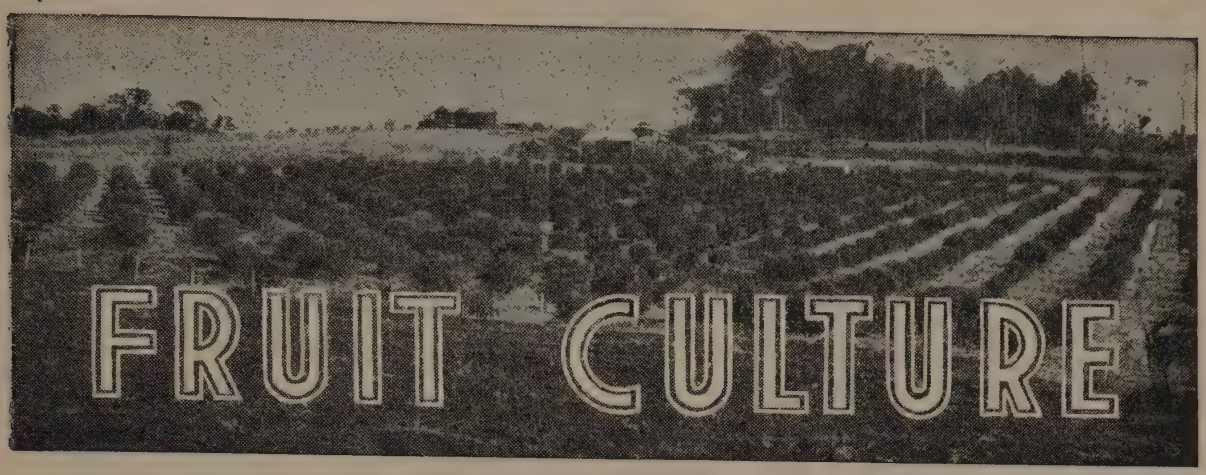
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Soil Conservation in Pineapples.

L. J. MISSINGHAM, Horticulture Branch.

SOIL erosion is a major problem in the pineapple-growing areas of south-eastern Queensland. Its seriousness is shown by declining soil productivity, gullies in cultivated ground, silted watercourses and half-buried fences.

The steep nature of much of the land utilised for the crop presents a natural erosion hazard. Evidence of soil movement may be seen in runoff water which is discoloured by suspended soil, in small rills in the field and in silt deposits on headlands and grassed waterways.

Silt deposits on headlands and elsewhere represent only a fraction of the total loss, for the smaller soil particles are carried away in rivers and creeks. Should this loss of soil continue unchecked, much land may eventually become unsuitable for crop production. In the meantime, its productivity declines and costs of crop production increase. Therefore, soil conservation is an essential feature of permanent and successful farming.

Erosion is caused by the impact of rain on the surface of the soil and by runoff water. Raindrops striking bare ground break down the soil aggregates, the amount of damage to the soil structure being influenced by the intensity of the rain, the stability of the aggregates, and the type of ground cover. The smaller particles detached from the aggregates seal the surface of the soil, and this, in turn, increases water runoff. The greater the volume and velocity of runoff water, the greater will be the soil loss. Both depend upon the amount and intensity of rainfall, the length and degree of the slope, and the mechanical obstructions to the movement of water. Erosion can therefore only be arrested by measures which maintain or improve the structure of the soil and control the movement of runoff water.

MAINTAINING SOIL STRUCTURE.

A soil with good structure consists mainly of "crumbs," which are particles of soil bound together in such a way that they are not easily separated. Such soils absorb water freely, and as the crumbs or aggregates are not so easily carried away by water as smaller particles, erosion is reduced to a minimum. The degree of aggregation varies widely from one soil type to another; many of the sands and sandy loams used for pineapple growing contain few stable aggregates and are therefore highly erodible.

Cultivation.

The stability of the soil structure depends largely on the treatment that the soil receives. Excessive cultivation tends to break down the aggregates, and fast-moving implements, particularly those with a pounding action, can do a great deal of damage. For this reason, the rotary hoe, which is sometimes used for incorporating cover crops into the soil, should never be used on trash-free ground.

Thorough land preparation prior to planting pineapples is none the less necessary. On virgin soils, cultivation should commence several months before planting, and on replant land the inter-cycle cover crop should be turned in sufficiently early to allow time for its decomposition before planting begins. The amount of pre-planting cultivation required depends upon the soil type. Very little cultivation is needed on some sandy soils, but the sandy loams which are usually selected for pineapples require two ploughings. Some heavier loams may benefit from a third ploughing.

The pineapple block may extend from one waterway to another and roadways in between can be ploughed, as they are easily reconstructed and consolidated later. Care should be exercised when ploughing to prevent the formation of depressions at finishing-off furrows, particularly when they coincide with road positions or lie adjacent to waterways. When ploughing is finished, a large diversion drain should be opened above the area, and additional surface drains across the slope must be provided. These cross-drains are particularly necessary if the land is being prepared for an autumn planting, as heavy rains are likely to occur at that time of the year.

Mouldboard ploughs are preferred to disc ploughs for land preparation, as the former are less liable to form a hard pan, which slows down the rate of water penetration into the soil.

On some shallow soils, underground drainage may be improved by deep ripping. In land which is free from roots, ripping should be done when the soil is dry so that the subsoil is shattered and large spaces remain between the clods. If the soil is wet, it may be merely compacted on the sides of the ripper tines and little improvement in drainage is obtained. Ripping is particularly useful when a shallow sandy loam surface soil grades into a loam subsoil. Best results are obtained by ripping downhill or at a slight angle to the slope.

Should the soil be too cloddy for planting, the tilth can be improved by harrowing. Harrowing may not be necessary if the final ploughing is done when the soil contains sufficient moisture to make it friable, for under such conditions implements do the least damage to the soil structure.

CONSERVATION OF ORGANIC MATTER.

In a soil erosion control programme, the conservation of organic matter is particularly important. It can be achieved by working the old pineapple plant residues into the soil at the end of the crop cycle and by cover cropping during the inter-cycle period. The destruction of old non-commercial pineapple areas by burning is an undesirable practice.

Cover Cropping.

As far as possible, land should be kept under a cover crop or crops during the inter-cycle period until preplanting cultivation begins. In land

which is so protected, rain trickles slowly through the foliage to the ground, damage from raindrop splash is eliminated, absorption is at a maximum and runoff is reduced to a minimum.

The cover crops commonly used are legumes such as cowpeas, New Zealand blue lupins and pigeon pea, and cereals such as maize, Sudan grass, sorghum, wheat, oats, millet and panicum. Cowpeas (Poona pea is the common variety), pigeon pea, maize, sorghum, Sudan grass, millet and panicum are sown in the spring or early summer, while New Zealand blue lupins, oats and wheat are planted in the autumn. Pigeon pea may be grown as either an annual or perennial cover crop.

The more important cover crops are usually sown broadcast on prepared ground at the following rates per acre :—cowpea, $\frac{1}{2}$ bus. ; pigeon pea, $\frac{1}{4}$ bus. ; New Zealand blue lupins, 1 bus. ; and maize, 1 bus. After sowing the land is harrowed and contour drains are opened up at half-chain intervals down the slope to minimise erosion should rain fall before the cover crop is established.

When a legume is selected for the cover crop and it has not been grown on the land previously, the seed should be inoculated with the appropriate strain of nitrogen-fixing bacteria.

On replant land which has become very acid following the use of fertilizers, an application of agricultural lime or dolomite is usually beneficial to the cover crop. It may be applied just before the land is ploughed. On the less fertile soils, a pre-planting dressing of fertilizer should be broadcast at the following rates before the crop is sown :—*Legumes*—$2\frac{1}{2}$ to 3 cwt. per acre of a 5–14–2 or similar mixture ; *cereals*—2 cwt. per acre of sulphate of ammonia. As bulk is desirable in any cover crop, fertilizer is required on all but the more fertile soils.

The cover crop should be turned in when the plants are in the flowering stage. Cutaway disc harrows and a rotary hoe are suitable implements for this purpose.

When a cover crop is turned in, the soil micro-organisms which decompose the organic matter utilize the soil nitrogen and the amount available for the following pineapple crop may be temporarily reduced. If, however, the pineapple crop is fertilized within two or three weeks of planting in accordance with standard practice, nitrogen deficiency symptoms should not appear. Nitrogen deficiency in a pineapple crop is easily recognised by the pale-green colour of the leaves and can be corrected by an application of sulphate of ammonia.

Mulches.

The pineapple plant is comparatively shallow-rooted and cannot compete successfully with an inter-row cover crop or weeds. Hence, although pineapple plants established in the usual double-row spacings afford some protection to the soil, a complete protective soil cover in the established plantation can be maintained only by surface mulching.

Stubble-mulching could be applied in pineapple-growing areas. The old crop residues and cover crops would then be chopped up and left mostly on the soil surface rather than completely buried in the ground as in normal practice. A disc harrow or a rotary hoe fitted with straight blades is a suitable implement for the job.

Sawdust, bagasse and other plant residues can be used as mulching materials when they are available at little or no cost to the grower. A

4-in. cover of sawdust or 6-in. cover of bagasse applied shortly after the pineapple crop is planted soon settles down to a 2–3 in. mulch. Should it be uneconomic or impracticable to mulch the whole plantation, strip mulching in the double-row is a worthwhile practice.

In lowlying plantations, mulches must be used with discrimination, as they tend to increase the risk of frost damage in a cold winter. In such areas, a light cover of some readily decomposable material may, however, be applied in spring on recently planted crops ; it should rot down before the following winter.



Plate 1.

A North Coast Pineapple Farm Planted on the Contour.

CONTOUR PLANTING.

Soil structure and fertility cannot be maintained if some of the topsoil is lost each year. Contouring practices are therefore complementary to measures which maintain the structure of the soil. Much of the land used for pineapple growing in south-eastern Queensland is steep, but soil erosion can nevertheless be largely controlled by good land management and the application of contouring practices. On moderate slopes complete erosion control can be achieved.

Broadly, the object of planting pineapples on the contour (Plate 1) in conjunction with contour drains is to make the best use of light rains and to control surface water during heavy downpours. The plant rows and contour drains which run across the slope slow down the flow of water, allowing more time for its absorption into the soil and the safe disposal of any excess on grassed waterways.

In planning a soil conservation layout for a farm, the property should be considered as a whole, so that the work done in one area will conform with that carried out at a later date in adjacent areas. The existing farm

layout may require considerable modification. However, even if the permanent waterways provided for in the plans cut through areas already under crop, it may not be necessary to construct them immediately.

Roads should be designed to give ready access to all parts of the plantation without increasing the erosion hazard. To minimise the area occupied by them, the roads should, for preference, run directly down the slope. At least one road with a reasonable gradient to the highest part of the plantation is essential, however, and if it cannot follow the crest of a ridge, it may have to be constructed across the slope. This road would be connected by subsidiary access tracks to another all-weather road along the lower side of the plantation. Where possible, roads are placed on ridges so that water may drain away from them. This is not always practicable, as access tracks in pineapple plantations must be spaced not more than four chains apart to ensure ease of harvesting. The roads are therefore placed at convenient intervals and waterways are then constructed midway between them.

Waterways.

Owing to the steep gradient of some pineapple areas, the construction and maintenance of stable water disposal channels presents the main problem in any drainage system. Natural well-grassed watercourses are utilised but it is usually necessary to construct additional grassed waterways in natural drainage lines or in selected locations. These waterways should be carefully planned and well constructed, as they are permanent; they should on no account be ploughed.

Water disposal channels should be of sufficient capacity to cope with the water that will be diverted into them and wide enough to prevent scouring. They will run more or less directly down the slope to simplify construction and ensure sufficient width and capacity. The width will depend upon the slope and the effectiveness of the protective grass cover. As a rough guide, the effective width (that is, from bank to bank) is calculated on a basis of 4–6 ft. for each acre of catchment. The bottom of the water channel should be nearly level to spread the water and reduce its scouring effect on the soil. In practice, a slight dish towards the centre with the lowest point about 12 in. below ground level is satisfactory. Without this fall from the drains to the channel, water tends to bank up behind the grass cover, and during heavy downpours may spill over and scour the edge of the cultivation.

The use of waterways as roadways is undesirable because of possible damage to the grass cover, but where such use is necessary, a pronounced depression between the wheel tracks is essential. Pneumatic-tyred vehicles do least damage to waterways and roads, but "slides" often open up gutters, which erode quickly.

A creeping perennial grass which thrives in the locality should be chosen for stabilising watercourses. Species with a vigorous underground runner system are undesirable as it is difficult to prevent them from encroaching on the pineapple plantation during the wet season. Satisfactory control, however, can be exercised over species with surface runners only, such as buffalo grass, blue couch and broad-leaved carpet grass, also known as mat grass. All weeds and grasses that germinate when the waterway is built should be allowed to remain until the permanent cover is established. Planting sods of the chosen grass in strips across the channel is the best way of establishing the permanent cover.

Contour Drains.

Contouring practices vary with the slope, the erodibility of the soil and the equipment available for drain construction. Generally, it is necessary to rely on contour banks, spaced at suitable intervals across the slope and supplemented by inter-row drains (Plate 2). If the slope extends uphill beyond the pineapple area, a large diversion drain is required to prevent surface water entering the plantation from above.

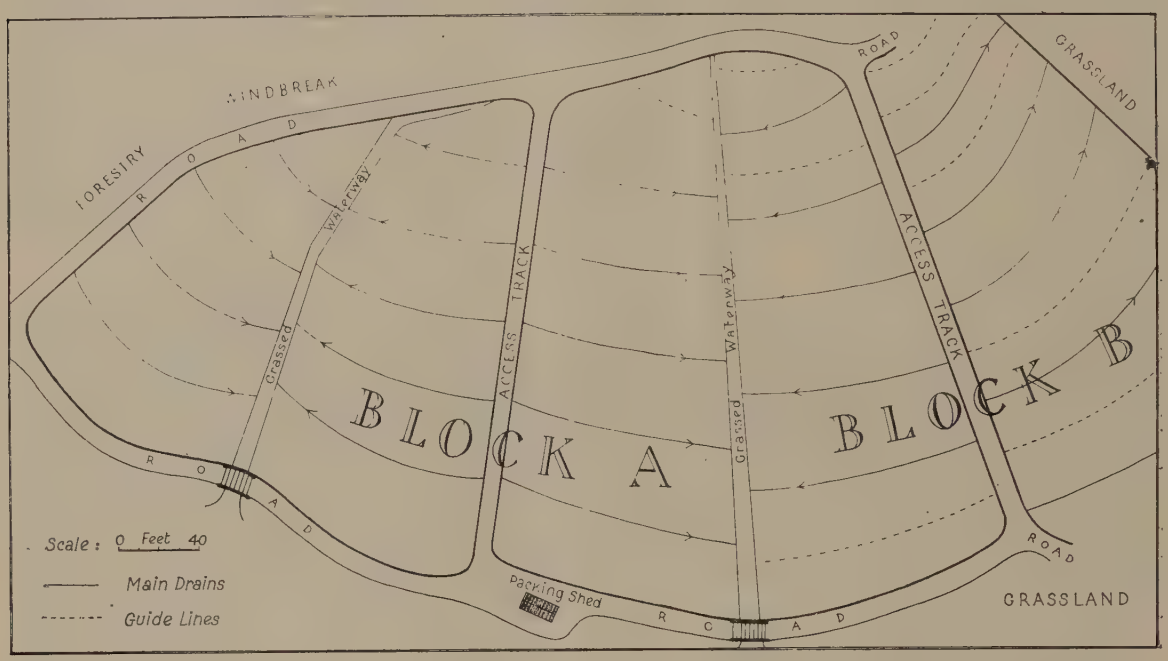


Plate 2.

Farm Plan Showing Contour Layout. In block A, survey lines are made at intervals of about 42 ft. for the main drains above the contour banks. In block B, a base line is struck for the main drain near the top and inter-row drains are marked parallel to it until the gradient deviates from the permissible limits; a second base line is then drawn for another main drain and further inter-row drains are marked out below and parallel to it. The procedure continues down the slope.

A contour bank consists of a large drain with the soil banked up on the lower side. The completed drain should be at least one foot deep and 18 in. wide at the base (Plate 3). Where a tractor can safely cross the slope, the bank may be constructed by means of a grader-ditcher or large plough and little or no hand work is necessary. However, the drains are usually opened up with the largest horse-drawn plough available and then cleaned out with a shovel. On relatively flat land, the soil may be thrown up on both sides of the drain. A tractor with suitable attachments can construct two drains and two beds parallel to the main drain and mark the position of the next drain in the one operation. On moderate slopes, the land can be cultivated between the contour banks, which are then permanent structures. On slopes with a gradient of more than 15% it is usually necessary to plough downhill across any existing contour banks, which must then be reconstructed before each planting; this involves a new survey.

The gradient of the drain above each contour bank should be sufficient to allow water to flow freely without ponding or overflowing its banks. On steep slopes, the gradient may be as much as 3%, that is, a fall of 3 ft. in 100 ft. of drain length. This fall provides a fair margin of error

for minor irregularities in the soil surface and minor deviations from the true gradient caused by side slips when the contour line is opened up with the plough. On lesser slopes, contour gradients may be reduced.



Plate 3.

Contour Banks Established at Intervals of Approximately 42 Feet Down the Slope.

On comparatively easy slopes, contour banks alone may be sufficient to control the runoff, but on steeper ground inter-row drains are necessary to prevent soil movement between the main banks; otherwise silting of the drain, topping-over and a breakdown of the system will result. The shorter the drain, the safer it is.

Inter-row drains (Plate 4) are usually constructed with a 10-in. mouldboard hillside plough and each should be capable of draining the 6 ft. space carrying a double-row of pineapples above it without topping-over. If water does break through these drains, it will be stopped at the first contour bank below and the damage will be confined to a limited area. It is usually necessary to re-open inter-row drains which have been temporarily blocked by soil drift; a 1-horse plough or some similar implement is a decided asset for this purpose. Reopening may not be necessary if the initial capacity of the inter-row drain is sufficient to cope with minor silting. Care should be taken to see that pineapple trash on replant land does not block the drain during the first heavy downpour.

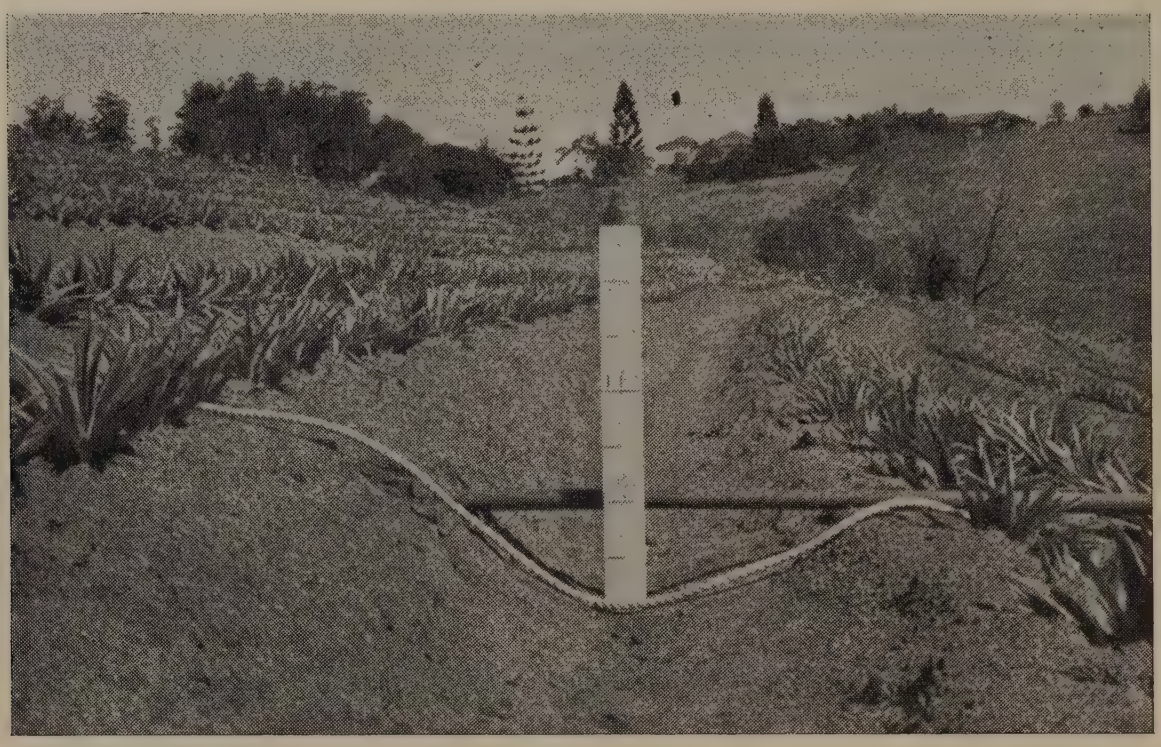


Plate 4.

Inter-row Drains in Contour-Planted Pineapples. These drains are established between adjacent paired rows.

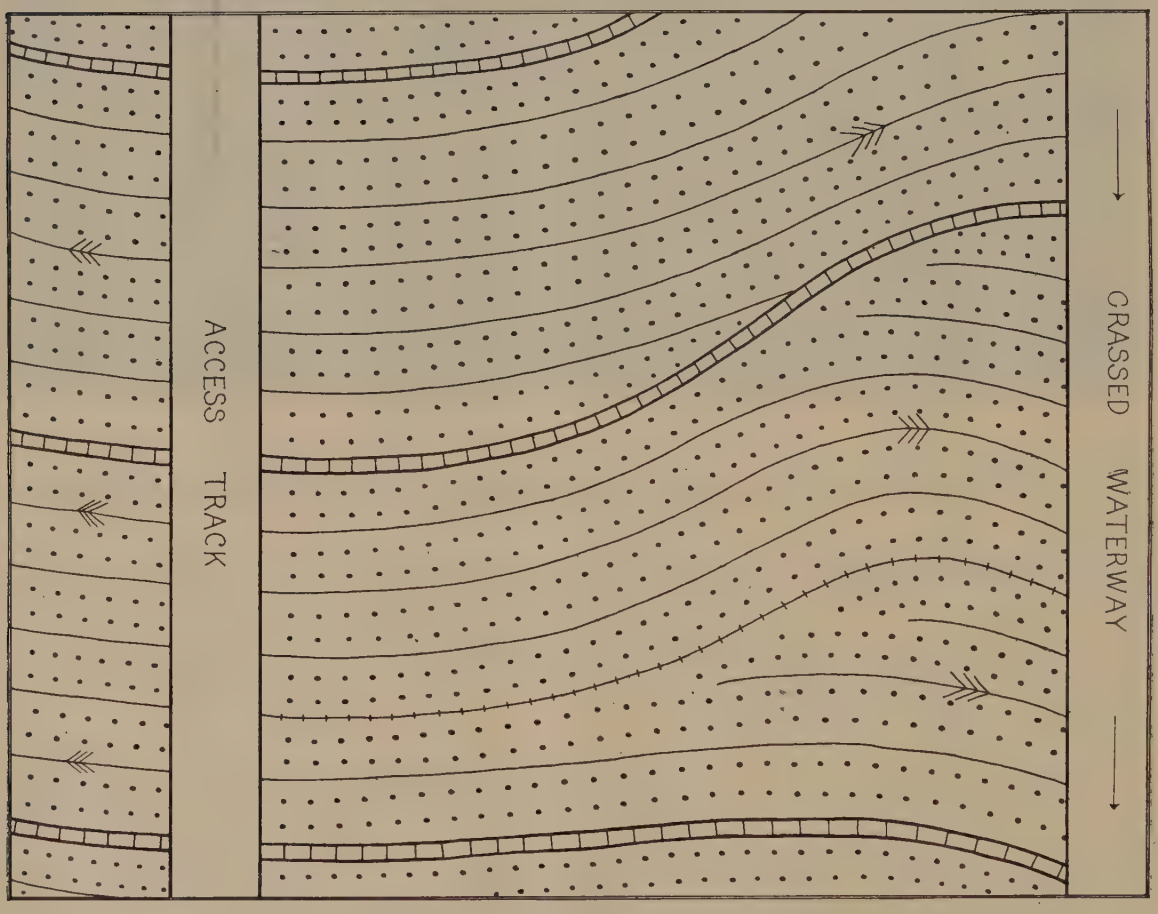


Plate 5.

Contour Layout A. Contour banks are at approximately 42 ft. intervals. The inter-row drains are parallel to one of the main drains.

Layout.

Several simple and inexpensive levelling devices may be used for marking out contours. A level of some kind is essential. The best for use in pineapple areas, where short-distance readings are taken, is possibly the Cowley Automatic Level; it can be easily set up and the work in progress is easily checked. Home-made apparatus incorporating a spirit level and boning rods, staff or an A-frame can also be used effectively.

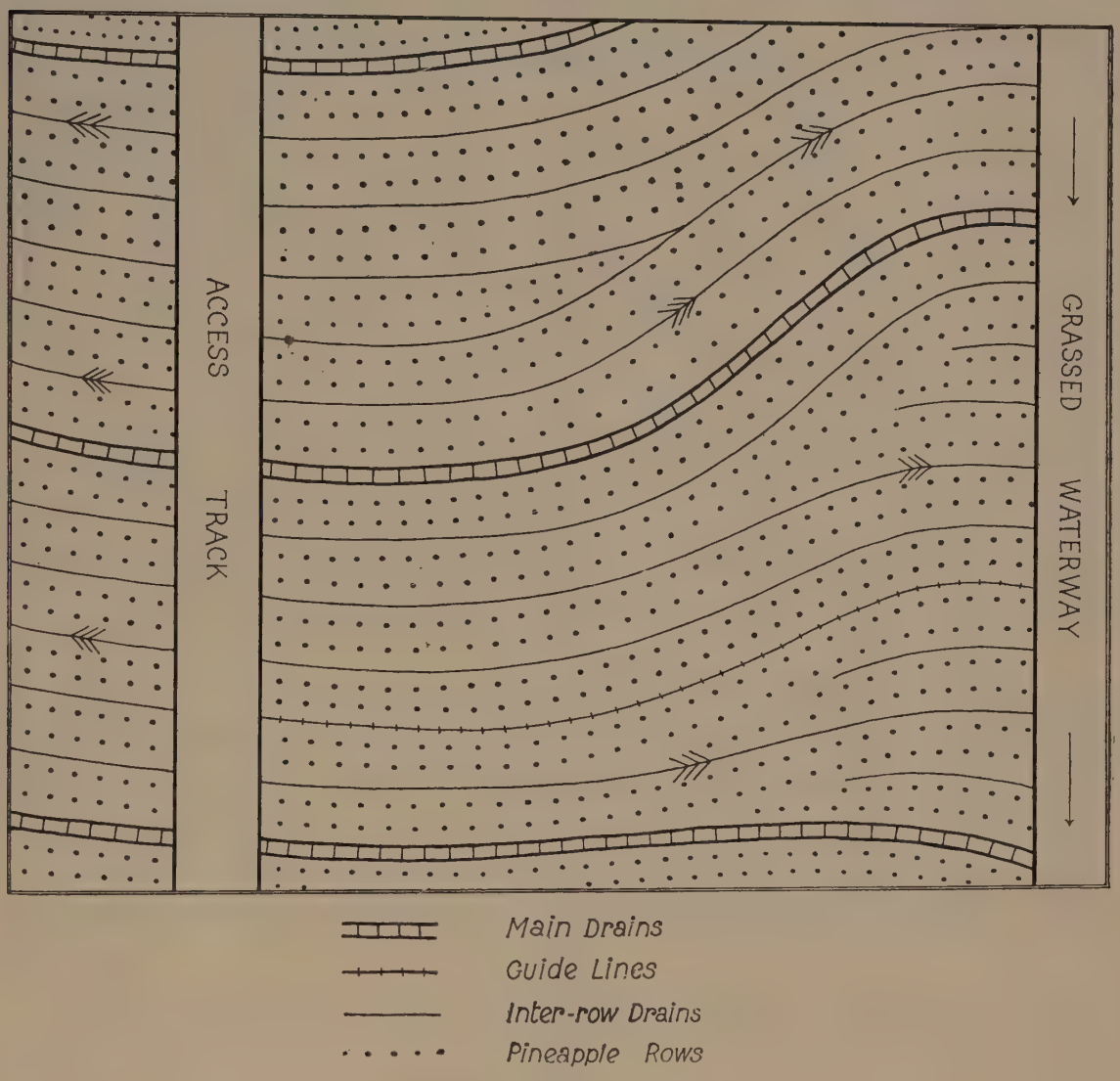


Plate 6.

Contour Layout B. Contour banks are at approximately 42 ft. intervals. The inter-row drains run parallel to both the upper and the lower main drains.

Perhaps the simplest method (Plate 5) of laying out the area is to strike off contour lines from the access track at intervals of about 42 ft. (or equivalent multiples of the row spacing to be used) for the main drains above the contour banks. Staff readings are usually taken and marking pegs are placed at intervals of 20 ft. or 25 ft. along the survey line; they may be much closer where sharp curves occur in the contour. Inter-row drains are marked out parallel to one of the main drains, so that where the space between main drains is greatest, the short spur rows used to fill it will all be adjacent to a main drain and have a slightly higher gradient. Should the inter-row drains be marked out parallel to the wrong guide line, the gradient of the spur rows will decrease and may become unsafe. The rule to follow is: When the space between surveyed lines for main drains is greater at the outlet than at the access track, inter-row drains are marked parallel to

the lower line ; but when the space between main drains is less at the outlet than at the access track, inter-row drains are marked parallel to the higher line (Plate 5).

The procedure is sometimes varied, the main drains being surveyed and the inter-row drains marked parallel to them (that is, up the slope from the lower main drain and down the slope from the upper). The open spaces between converging rows are filled in by spur or point rows (Plate 6).

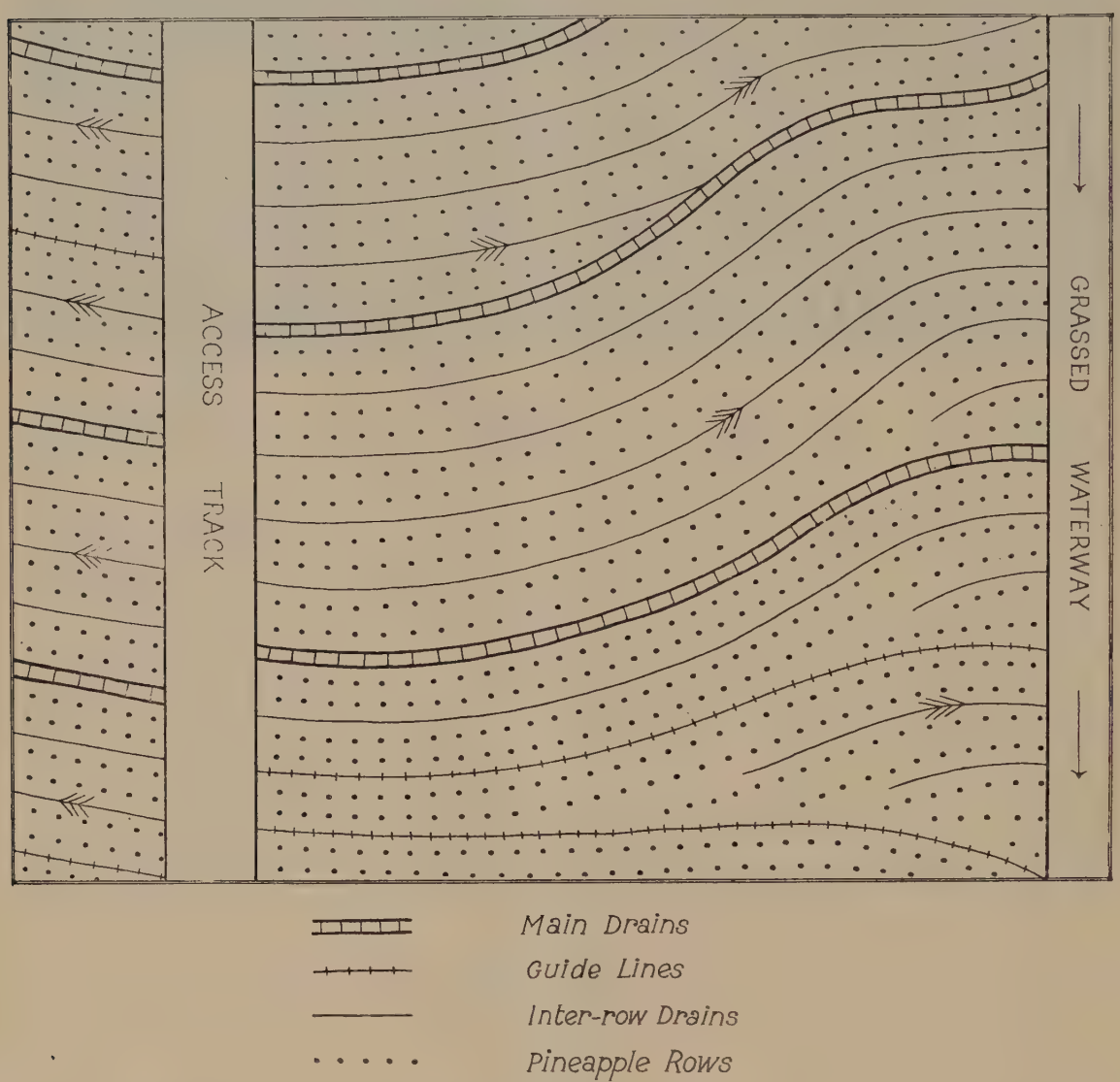


Plate 7.

Contour Layout C. Contour bank constructed near the top. The inter-row drains are marked parallel to it until the gradient exceeds permissible limits; a new base line is then struck for either another main drain or another inter-row drain as may be necessary.

In these methods of contouring, the drains on one block are in line with those of the adjacent block on the other side of a road. They can therefore be ploughed in together by crossing the access track without a break. The furrows crossing the track are later filled in but shallow depressions are left in the main drain positions to divert water from the road.

Another method (Plate 7) of marking out a pineapple area is to proceed down the slope from a base line (that is, surveyed graded contour for a main drain) near the top of the area, and marking out inter-row drains parallel to it until either the maximum or minimum permissible gradient is reached. A new base line is then surveyed and the same procedure followed. This

method gives a reasonably accurate contour layout as all drains are kept within the required gradient limits. However, on irregular land it involves the construction of more main drains than other methods.

Whatever method of contour layout is used, minor variations in spacing between the contours or sharp bends in contour lines may be smoothed out by variations in the spacing and gradient of inter-row drains. These variations must be used with discrimination, for if they exceed certain limits there is a risk of topping-over during heavy rain. Minor irregularities in the ground can also be troublesome and it is best to level off the surface as much as possible before commencing contour work.

All drains should be constructed before planting commences. They may then be used as guides in planting and no planting line is necessary. A double row of pineapples is planted on the large (lower) bank of the main drains. The other double rows should be established nearer the drain above than the drain below, so that minor soil drift will not expose the roots of plants in the lower row.

Cultural Problems in Contoured Pineapples.

The application of contouring principles to the pineapple crop may present some cultural problems on steep slopes and on poorly drained soils. Sub-surface tile drains may be required in shallow soils which are subject to waterlogging, but not in the deep open-textured soils normally selected for the pineapple crop.

Bad drainage can be offset by constructing raised beds on the contour for each double row of plants. However, if the beds are placed directly down the slope, as is sometimes done, the runoff is concentrated in the furrows between them and the erosive force of water is increased. In the long run, therefore, this latter practice defeats its object; as the land is washed away it becomes shallower and less suitable for cropping at each successive planting.

If the inter-row drains are fouled during chipping operations, recleaning is necessary. However, with the general use of weedicides such as PCP, hand-pulling is usually sufficient to control the surviving weeds. Should it become necessary to use a hoe for the destruction of weeds, a chip hoe is preferable to a push hoe, and the soil should be drawn towards the plants.

Some of the fertilizer placed on the lower side of the plants may be washed away if the crop is planted on the contour. To offset this, the fertilizer can be distributed on the higher side of plants until the inter-row space is overgrown. After that, base leaf applications may be made with less risk of loss.

These minor disadvantages of contour planting in the pineapple crop are also characteristic of plantations planted in straight rows across the slope—a common practice in some areas. In such plantations, the crop may be more easily handled but erosion still occurs.



The Honey Flora of South-Eastern Queensland.

S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture), Science Branch.

(*Continued from page 257 of the November issue.*)

Banksia or Honeysuckle Oak.

Botanical Name.—*Banksia integrifolia* Cav.

Other Common Names.—Bottle-brush, grey or white honeysuckle.

Distinguishing Characters.—A small tree with leaves very white underneath, and thick dense spikes of yellow flowers (Plates 56–58).

Description.—This is a small bushy or sometimes straggling tree usually less than 30 ft. in height, with a light-grey, roughened bark. The leaves are broadest a little below the tip and taper to the short stalks, and are quite white underneath except for the yellowish veins; they measure about 2½–4 in. long and about ½–¾ in. wide. The yellow flowers are borne in dense spikes about 2–5 in. long and 2–2½ in wide; each flower has 4 very narrow spreading "petals," each with an anther seated in a little depression near the end, and a long, curved style.

Distribution.—Chiefly on sandy soil in coastal districts; occasionally met with inland. The species is fairly common in eastern Australia.

Usual Flowering Time.—April to May.

Colour of Honey.—Dark amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium.

General Remarks.—This tree provides ample nectar and pollen. It flowers often in association with paper-barked tea-trees, and the properties of the honey are usually masked in the natural blend obtained by colonies working these two species. In good banksia locations colonies breed heavily, and it is advantageous for migratory beekeepers to select coastal tea-tree sites that have banksia within flight range.

A pure sample of this honey has weak density and a strong flavour typical of the *Banksia* group. It candies with a coarse hard grain and is difficult to reliquify. Such honey sells slowly on the market unless it is the minor honey of a blend.



Plate 56.

Banksia (Banksia integrifolia). Leaves with spike of flower buds. The leaf is white underneath, as shown in the inset.

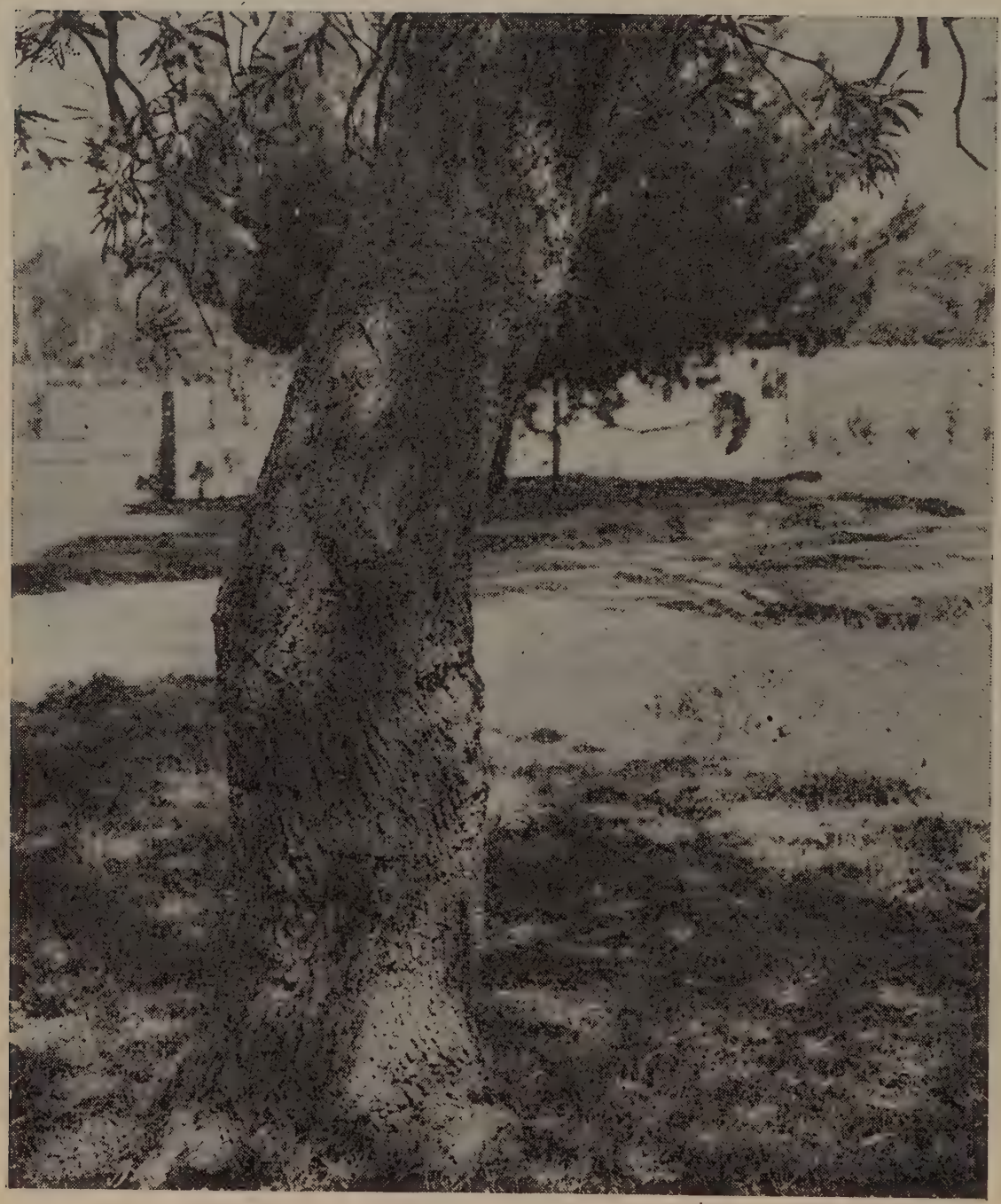


Plate 57.

Banksia (Banksia integrifolia). Portion of trunk.



Plate 58.

Banksia (Banksia integrifolia). Deception Bay.

Narrow-leaved Ironbark.

Botanical Name.—*Eucalyptus crebra* F. Muell.; sometimes called *Eucalyptus racemosa* Cav.

Distinguishing Features.—This is an ironbark (Plates 59–60) with very narrow leaves, often resembling the grey ironbark (see under that species).

Description.—A tree up to 100 ft. high, with hard, thick, very deeply furrowed, very dark grey to black bark, and a fairly compact dull, often greyish crown of slender twigs and drooping leaves. The leaves are 7 or more times longer than wide, about 3–6 in. long and $\frac{1}{3}$–$\frac{3}{4}$ in. wide. The flowers are produced in bunches at and near the ends of the twigs, and are about $\frac{1}{2}$ in. wide when fully out; the buds have a blunt or pointed lid from half as long to about as long as the rest of the bud. The seed-capsules are roughly cup-shaped, about $\frac{1}{5}$ in. long and wide.



Plate 59.

Narrow-leaved Ironbark (Eucalyptus crebra). Left, branchlet with leaf and seed-capsules. Right, branchlet with leaves and flower buds.

Distribution.—Throughout south-eastern Queensland, but not common near the coast. It often forms stands in stony or sandy soil, especially in the districts of Burnett and Darling Downs. The species is widely spread in eastern Queensland and eastern New South Wales.

Usual Flowering Time.—August to December.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Minor to major.

Importance as Source of Pollen.—Major.

General Remarks.—This tree is an erratic producer of nectar, yielding good harvests in only one of four or five years. On the Darling Downs, however, up to 160 lb. of narrow-leaved ironbark honey may be harvested by each colony when conditions are favourable. Such good nectar flows

usually occur when rain falls shortly before flowering. In the Maryborough district this species has a good reputation, whereas in other coastal areas its status is that of a minor producer.

Narrow-leaved ironbark is one of the few ironbarks which produce pollen in quantity, and this feature enhances its value to the beekeeper.

This choice honey is dense, has excellent colour and a mild sweet flavour ; it granulates slowly with a whitish coarse grain.



Plate 60.

Narrow-leaved Ironbark (Eucalyptus crebra). Chinchilla district.

Blackbutt.

Botanical Name.—Eucalyptus pilularis Sm.

Other Common Name.—Grey blackbutt.

Distinguishing Features.—A tall tree with grey or dark grey bark rather like that of a stringybark on the lower or greater part of the trunk, smooth and whitish elsewhere, and with nearly rounded, woody-looking seed-capsules about ½ in. long and wide (Plates 61–62).



Plate 61.

Blackbutt (Eucalyptus pilularis). Left, branchlet with seed-capsules. Right, branchlet with leaves and flower buds.

Description.—This is a tree up to 150 ft. or more high with a compact crown. The bark on the lower or greater part of the trunk is rough and fibrous, somewhat like that of some stringybarks, naturally grey or grey-brown but often black as the result of fires ; on the rest of the tree the bark is smooth, whitish, and often marked with scribbly lines like that of the scribbly gum. The leaves are glossy green on both sides, tapering upwards to a point, about 5–8 times as long as wide, usually 4–5 in. long. The flowers are borne in small bunches among the leaves and are about ½ in. wide when

fully out; the lid is about as long as the rest of the bud and often has a distinct point. The seed-capsules are on short stalks, nearly rounded, with thick walls, and $\frac{1}{3}$–$\frac{1}{2}$ in. long and wide.

Distribution.—Chiefly in the higher rainfall areas of the Moreton and Wide Bay districts, sometimes forming nearly pure stands. It also occurs in eastern New South Wales and eastern Victoria.

Usual Flowering Time.—February to April.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.



Plate 62.

Blackbutt (Eucalyptus pilularis). Clump at Caloundra.

General Remarks.—Blackbutt is not a good honey tree and beekeepers do not depend on it for honey production. Occasionally, however, it will yield useful but moderate quantities of nectar, although as many as seven or eight years may separate such flows. On such occasions the harvest may often be quickly and adversely affected by apparently small changes in the weather. A fair supply of pollen is obtained regularly from blackbutt and this stimulates breeding.

This second-grade honey has a strong sharp flavour and poor density. As it does not candy readily it is quite useful for blending with choicer honeys.

Narrow-leaved Grey Gum.

Botanical Name.—Eucalyptus seeana Maiden.

Other Common Names.—Narrow-leaved cabbage gum, forest red gum, blue gum, grass gum.

Distinguishing Features.—This is usually a crooked tree with smooth greyish white blotchy bark, pendulous twigs, and pendulous, narrow dull green leaves, very long lids to the buds and long pointed valves to the seed-capsules. It resembles the blue gum in bark, foliage and the long lids of the buds, but it is often a crooked tree, the leaves are narrower, especially on young trees and suckers, and the valves of the seed-capsule are erect, not curved inwards (Plates 63–64).



Plate 63.

Narrow-leaved Grey Gum (Eucalyptus seeana). Branchlets with leaves, flower buds and seed-capsules.

Description.—Usually a crooked tree and rarely higher than 50 ft. The bark is smooth, greyish white, usually with darker patches. The crown is somewhat sparse with long, drooping twigs and leaves. The leaves are very narrow (7 or more times longer than wide), mostly 4–7 in. long and

mostly less than 1 in. wide, flexible. The flowers are borne in clusters among the leaves and are about $\frac{3}{4}$ in. wide when fully out; the lid is at least twice as long as the rest of the bud, narrow and pointed. The seed-capsules are more or less cup-shaped with 3 or 4 erect, sharp-pointed valves about $\frac{1}{4}$ in. long and wide.

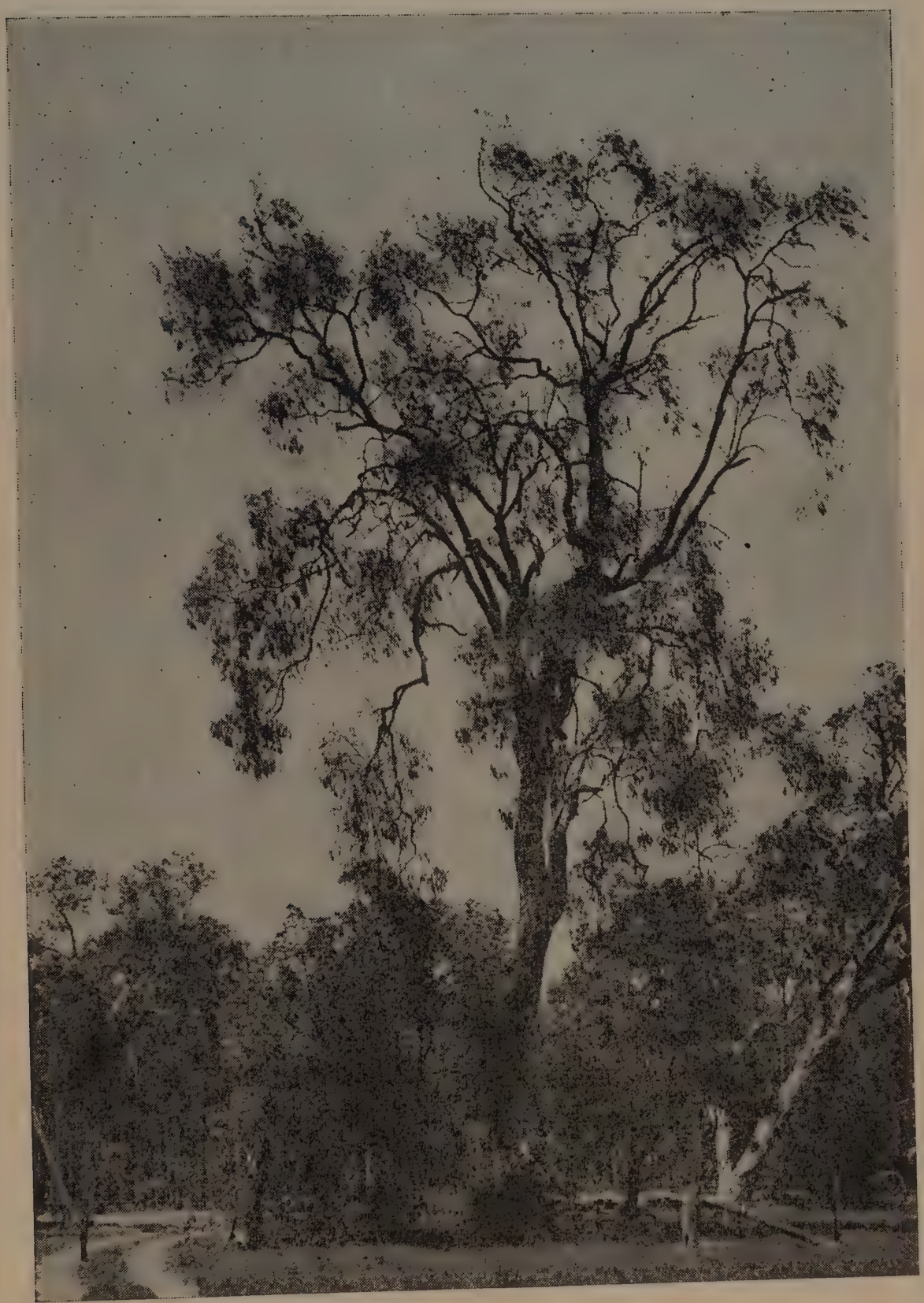


Plate 64.

Narrow-leaved Grey Gum (Eucalyptus seeana). Deception Bay.

Distribution.—Moreton, Wide Bay and eastern parts of the Darling Downs Districts, chiefly on ill-drained sandy soil in mixed forest country. It is also in north-eastern New South Wales.

Usual Flowering Time.—September to December.

Colour of Honey.—Clear medium amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium.

General Remarks.—This species flowers heavily and produces an abundant supply of nectar and pollen. As some trees bloom more or less every spring, colonies are stimulated to build up in strength quickly, thus ensuring that the subsequently more important nectar flows of other species are worked fully. During a favourable season colonies may gather a surplus of narrow-leaved grey gum honey. This honey is marketed usually as " blue gum " honey, few beekeepers realising that it is slightly different from that obtained from the blue gum (*Eucalyptus tereticornis*), which often flowers at the same time.

Narrow-leaved grey gum honey has a pleasant aromatic flavour and moderate density. Its granulating properties are not known.

[TO BE CONTINUED.]

INOCULATION OF LEGUME SEEDS.

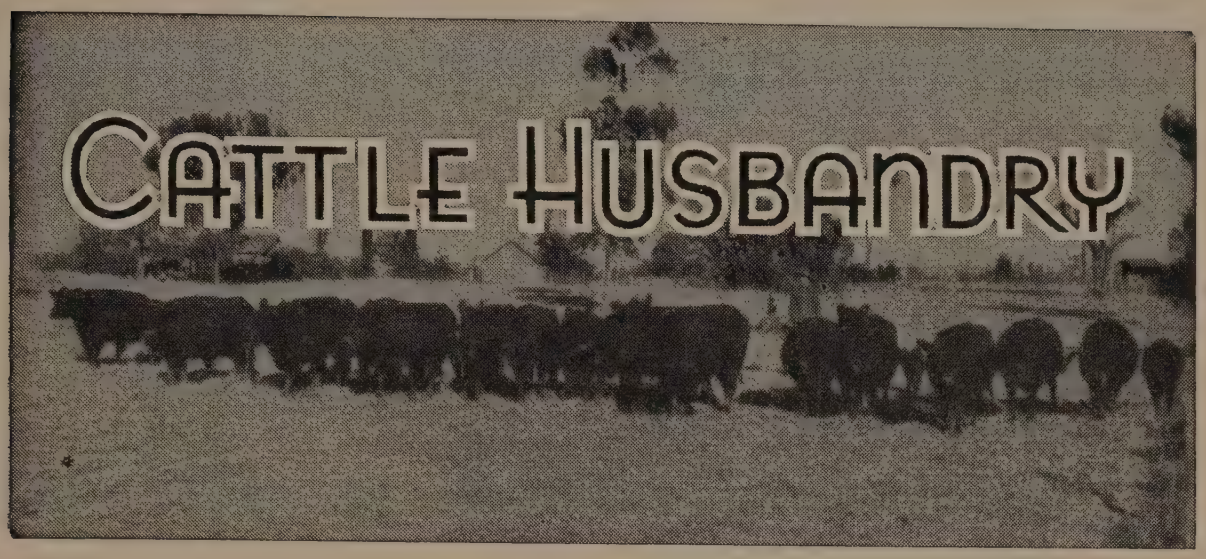
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The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.



Good Yards For Cattle Drafting.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

MANY graziers have devoted a lot of thought and ingenuity to devising suitable yards for cattle, and many good yards are to be found, but the yards on some properties leave much to be desired.

The accompanying ground plan illustrates a yard designed and built by Mr. Geo. L. Smith, of "Lucona Downs," Wallumbilla, which is suitable for the drafting of up to 400 mixed cattle by one man without assistance.

The area covered by these yards is 100 ft. square, but the size and layout could be enlarged or modified to suit larger or smaller herds.

It will be noticed that for convenience of drafting many of the gates swing both ways, and where they are in adjacent corners they can overlap to divert cattle into the various yards.

The gates of the pound yard are operated from the raised platform by overhead swords, and this enables cattle to be drafted four ways from the pound without the operator leaving his position on the platform.

The diameter of the pound yard is 16 ft. and the centre 3 ft. inside the main fence line.

Holding paddocks abut onto the yards, providing wing fences onto the ingress and egress gates.

Yard fences are 5 ft. 6 in. high, with three rails and cap. Panels are 10 ft. from centre to centre.

The gate in the side of the calf crush swings inside to force the calf into the branding machine, and a light iron garden gate is hung from the yard fence in front of the branding machine. This can be pulled across if the calf has a tendency to bolt through the machine, and is retracted automatically by a spring.

It is felt that the ideas incorporated in this plan could be used to advantage in many other yards.

Mr. Smith has not found a sword bail necessary, but this could be inserted in the crush without difficulty; it is found very useful where operations such as dehorning are practised.

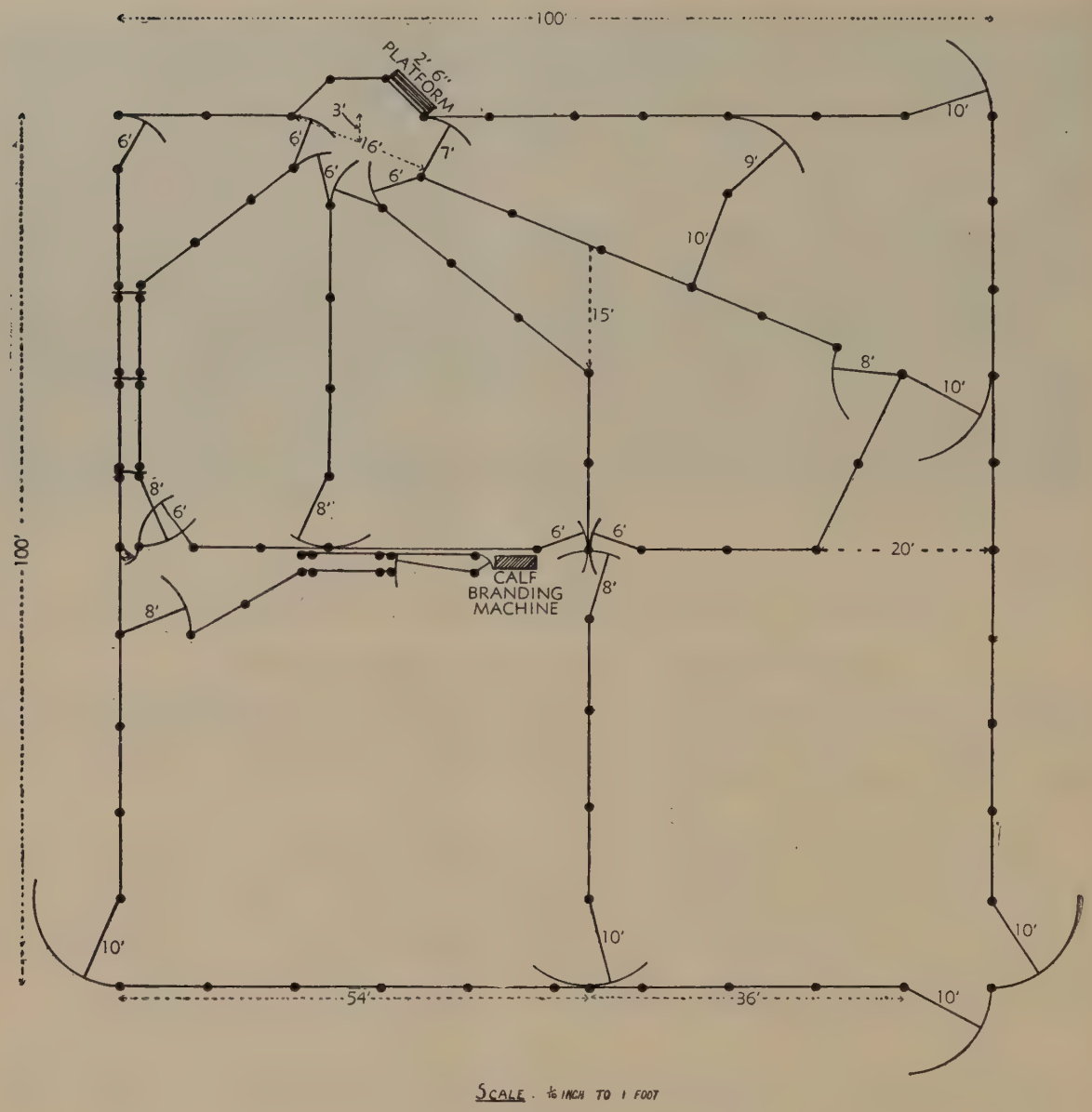


Plate 1.

Plan of Drafting Yards on "Lucona Downs," Wallumbilla.

A Crush Bail for Dairy Cows.

P. ROUND, Senior Adviser, Cattle Husbandry Branch.

WHEN operations such as dehorning, bleeding, inoculation, branding and drenching have to be performed on dairy cows, the need for a crush in which to secure the animal becomes obvious.

A cow should never be upset when in the milking bail, and when operations other than milking have to be performed they should never be carried out in the milking bail.

A special crush bail should be built. It should be so constructed that cows can be easily driven into it and safely secured without danger or distress to either man or beast.

The accompanying illustrations are of a crush bail that has been designed for use in conjunction with the combined dairy shed. It is simple and

effective, and being constructed off the exit race from the bails obviates the necessity of building a forcing yard. The cows walk through the bails in the ordinary way, and are diverted into the crush by closing a gate at the end of the exit lane.

Where no exit lane is provided on the milking shed, the crush can be constructed in a suitable corner of the yard, but a forcing yard is then required.

Materials Required for Construction of Crush.

Sawn Timber.

6″ x 1″	150 lin. ft.	= 75 sup. ft.
5″ x 2″	32 (4/8) lin. ft.	= 27 sup. ft.
6″ x 3″	6 (1/6) lin. ft.	= 9 sup. ft.
5″ x 3″	6 (1/6) lin. ft.	= 7 sup. ft.
4″ x 2″	16 (4/4) lin. ft.	= 12 sup. ft.

Posts.

5 posts ..	10″ x 9′
1 post ..	12″ x 9′

Bolts.

¾″ x 4″	12
⅜″ x 3½″	40
½″ x 10½″	9
½″ x 7½″	5
½″ x 4″	1

Hinges and Gudgeons.

1 pair ..	2′ 6″
1 pair ..	1′ 8″

Flat Iron.

Two lengths (bored).

Materials for Gate at End of Race.

Sawn Timber.

6″ x 1″ .. .. 50 lin. ft. = 25 sup. ft.

Bolts.

⅜″ x 4″	6
⅜″ x 3½″	9

Hinges and Gudgeons.

1 pair .. .. 1′ 8″



Plate 1.

Cow Leaving the Bails and Approaching the Crush.



Plate 2.
Front of the Crush, with the Bail Open.

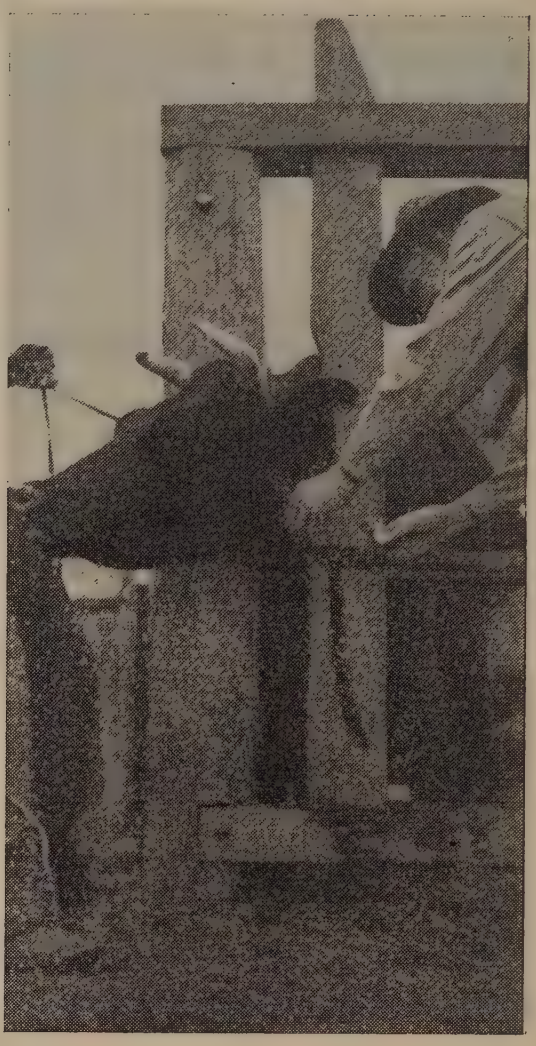


Plate 3.
Cow Being Bled in the Crush.



Plate 4.
Cow Being Released from the Crush.

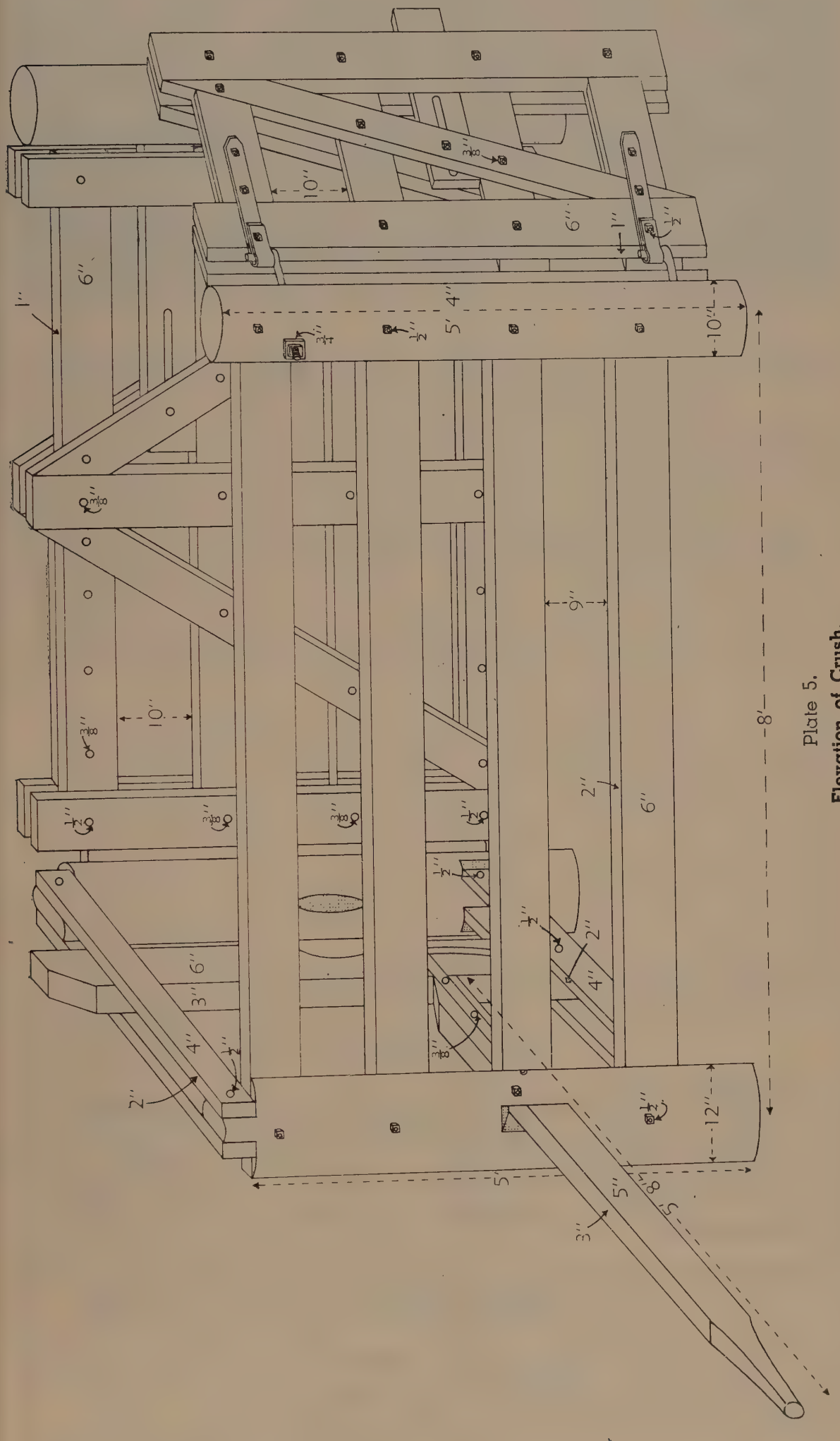


Plate 5.
Elevation of Crush.

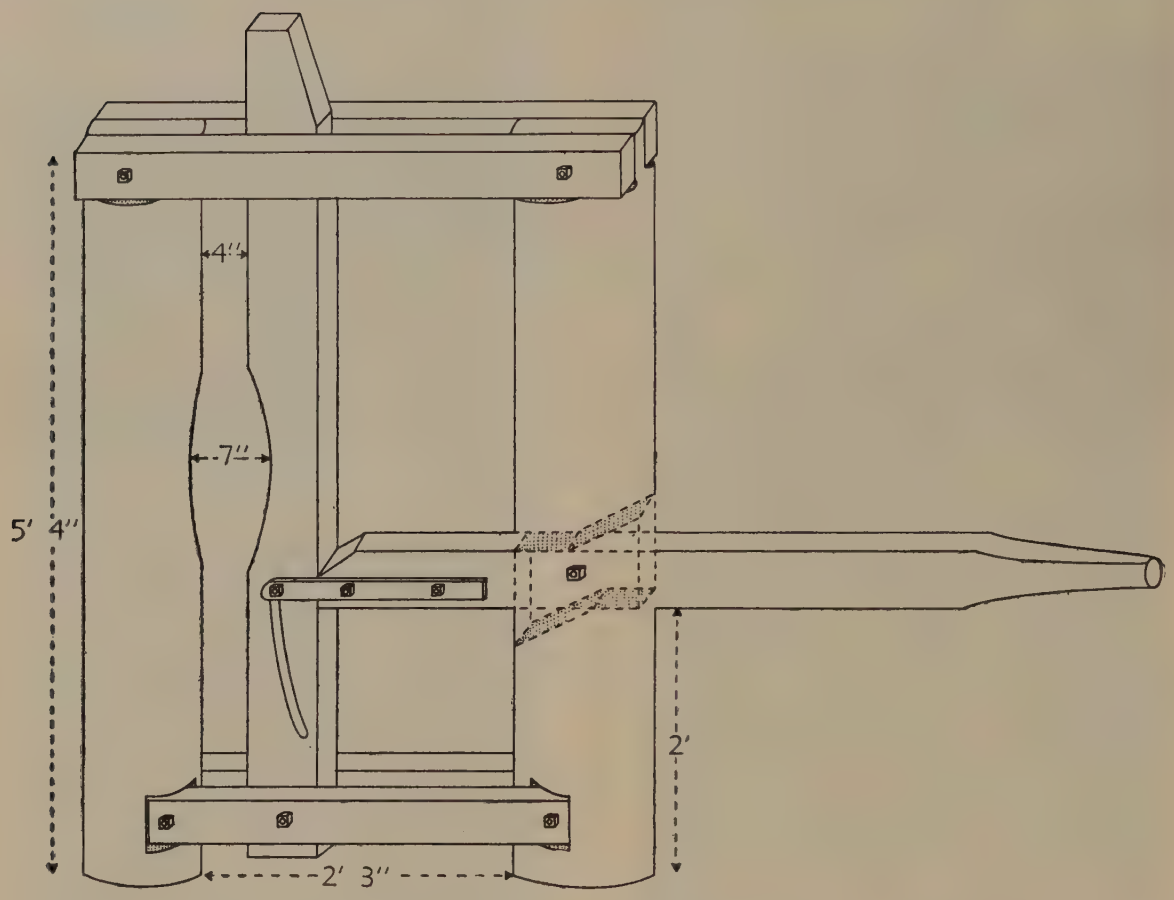


Plate 6.

Front Elevation of Bail.

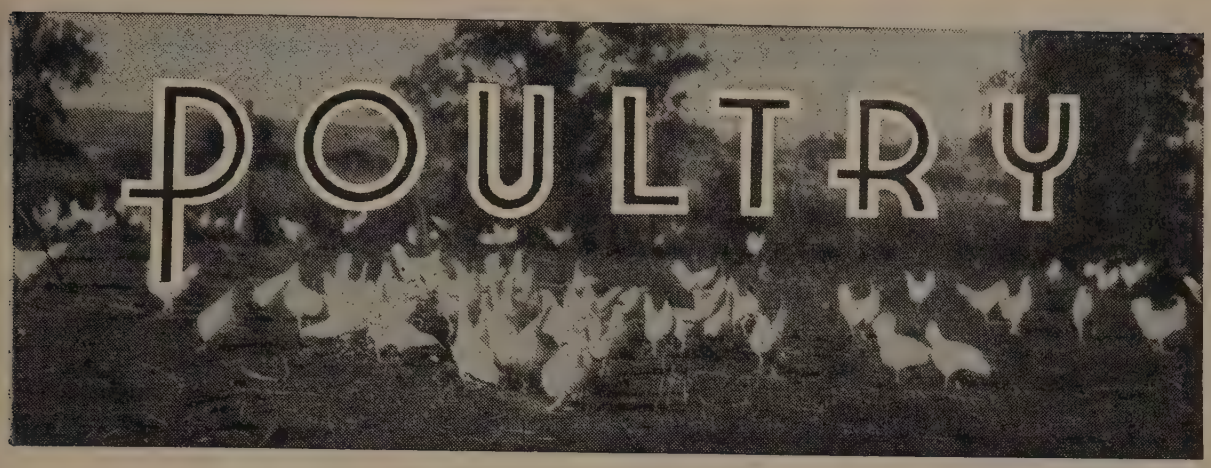
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Feeding Fowls From Day-Old to Maturity.

F. N. J. MILNE, Assistant Husbandry Officer, Poultry Branch.

IT should be realised by poultry raisers that the nutrition of a chicken does not begin at hatching. The diet of the breeding hen can have a marked influence on the growth of the chicken during its first few weeks of life. Perhaps the vitamin A content of the breeder's ration has the greatest effect on livability of the chicken, and it is therefore necessary to use succulent green feed or fish oils (or both, if necessary) in the ration of breeding hens.

It is proposed in these notes to discuss the feeding of fowls in the brooder period, the weaning period, and the period from weaning to maturity.

The Brooder Period—Day-old to 4 Weeks.

The first four weeks of life could be called the critical period because this is the brief space in which the chick (*a*) is dependent on yolk sac reserves (for the first week or so), (*b*) can only eat a limited amount of food, and (*c*) grows at relatively faster rates than at any other time. It is during and generally towards the end of this period that we find vitamin and mineral deficiencies appearing very quickly and with disastrous results. Such rapid growth calls for rapid assimilation of all food constituents, whether they be protein, carbohydrate, fat, vitamins, or minerals. Rapid assimilation therefore requires a special type of ration—a chick starter mash which should have the following characteristics :—(1) high protein content (a minimum of 18%), (2) low fibre content (5% is a good level), (3) adequate supplies of vitamins A, D3 and riboflavin, and (4) minerals such as calcium, phosphorus and manganese.

Protein.—A high-protein mash with a minimum level of 18% is needed. If vegetable proteins such as soybean meal and peanut meal are used, at least 5 lb. of meatmeal would have to be added to improve the "protein quality" of the mash and to supply sufficient vitamin B12. If vegetable proteins were freely available in Australia, then such a ration would still need a riboflavin and vitamin B12 rich supplement such as livermeal to ensure a full supply of vitamins.

Fibre.—Chicks have their limitations with respect to the amount of fibre they can digest. For this reason, mill-offals should not be used to the same extent in starter rations as in those for older birds.

Lucerne meal or fine chaff could be fed at the rate of 2% to supply the chick's requirements of vitamin K (the anti-haemorrhagic vitamin)

but recent research has shown that lucerne meal or chaff has a growth-depressing effect on chickens, not related to its high fibre content, when fed at levels of 5% or more.

Vitamin A.—Because chickens do not eat a lot of food during the first few weeks of life, it is questionable whether they can eat sufficient green feed to supply their wants ; also it is not certain how much " carry-over " of vitamin A there has been from the parent birds. It is therefore a wise precaution to *always* include cod-liver oil or fish-oil emulsion in chick starter rations. It may increase the cost of feeding slightly, but it is better to be sure than sorry.

Vitamin D3.—Vitamin D3 is present in cod-liver oil and in fish-oil emulsions fortified with vitamin D3. It can also be synthesised by the chick through the action of the ultra-violet rays of sunlight on certain fatty substances in the skin. Vitamin D3 promotes absorption of calcium and phosphorus and helps in their combination and deposition as bone.

"Rickets " in young chickens is easily detected by the presence of soft, rubbery beaks, " beaded " ribs, ragged-looking feathering and a desire by the chicks to squat down as often as possible to " rest their rickety bones." It is caused by a lack of vitamin D3, calcium, or phosphorus, or too much calcium or phosphorus in the ration. Generally the most frequent cause is brooding chickens in the absence of sunlight without a vitamin D3-rich fish-oil or emulsion being added to the mash. It is essential therefore to supply cod-liver oil or fish-oil emulsion A and D3 for battery-brooded chickens. This recommendation could be carried further to include *all chickens irrespective of how they are brooded*, because there are many occasions during the early rearing period when a farmer would not expose very young chickens to cold westerly winds or bleak overcast days encountered in outside runs.

Riboflavin.— A deficiency of this vitamin produces " curly-toe " paralysis in chickens. Just as riboflavin deficiency, affecting hatchability, will occur in breeding birds fed a laying mash instead of a suitable breeder's mash, so in young chickens this deficiency generally occurs when laying or growing mashes are fed to chickens in place of a good chick starter ration.

As the chickens grow older their requirements of riboflavin decrease. Livermeal (5%), buttermilk powder (7%) and whey powder (7%) will ensure adequate amounts of riboflavin in the ration. In their place, synthetic riboflavin may be used. In experimental work carried out by the Poultry Branch at the Kairi Regional Experiment Station in North Queensland over the past five years, synthetic riboflavin has been used exclusively in chick rations because the riboflavin-rich foods mentioned above are unobtainable there. However, it must be kept in mind that synthetic riboflavin supplies only one vitamin whereas livermeal, for example, supplies highly valuable protein and a whole range of B-complex vitamins, including riboflavin.

Vitamin B12.—The quantity of Vitamin B12 inherited from the hen depends (as with, for example, vitamin A) on the amount present in the breeders' ration. Vitamin B12 is essential for growth and provided good quality chick-starter mashes with the protein supplied by animal protein are fed, a deficiency should never be encountered.

Calcium.—This is not a real problem in chick feeding but it is a good idea to give the young chickens a small amount of finely crushed shell grit (2 lb. to 100 lb. mash) during the early period of life.

Phosphorus.—The quantity of meatmeal or other animal proteins used in chick starter mashes in Queensland to give a minimum protein level of 18% will ensure an ample supply of phosphorus.

Manganese.—A few cases of "perosis" or "slipped tendon" have been diagnosed by the Animal Health Station, Yeerongpilly. But because these are so few it does not mean that there may not be "marginal" deficiences in some of our rations. A ration in which bran and pollard are not present or are used in limited quantities (under 40%) has a borderline manganese content. To offset a possible manganese deficiency, 6 oz. of commercial grade manganese sulphate should be added to every ton of mash.

Of the grains, wheat is the best source of manganese, but the manganese content of any grain is insufficient for the birds' needs. Maize has the lowest manganese content of all grains and the addition of manganese sulphate is necessary where maizemeal forms 50% or more of an all-mash chick starter ration.

The Weaning Period—4 Weeks to 8 Weeks.

Although the rate of growth is beginning to slow down, no differentiation is made in the type of ration required during the brooder and post-brooder stage, so the requirements that appertain to the first four weeks of life apply equally in the ensuing four weeks.

With regard to vitamin A, it is well to bear in mind that although the chicken's capacity for food is increasing, so are its requirements for this vitamin and that it is reaching a stage where it may have to face the hazards of coccidiosis (both caecal and intestinal), fowl pox (if vaccination is not practised) and roundworm infestation. Vitamin A does confer some resistance on the growing chicken to enable it to withstand these troubles. For that reason it is a wise precaution *to continue the use of cod-liver oil or fish-oil emulsion for the first eight weeks of life.*

Weaning to Maturity.

During this period growth decreases while the amount of food eaten increases. A mash and grain system or an all-mash system of feeding may be adopted, but in either case, the protein content of mash or mash and grain should be about 16%. More fibrous foods may be used in greater quantities.

Growing stock after weaning do not require the previous high levels of riboflavin and thus the amounts of such costly riboflavin-rich foods as livermeal, buttermilk powder and whey powder may be reduced in or deleted from the ration. Vitamin A supplements such as cod-liver oil or a fish-oil emulsion are necessary only if green feed is in short supply, an adequate amount being 5 lb. of fresh green feed per 100 birds per day. It must be stressed again that a shortage of vitamin A during this period can undo all the care and attention given to young pullets and cockerels during the brooder and weaning stages.

As the pullets approach maturity their calcium requirements increase in anticipation of their natural function—egg production. Most of the calcium is deposited as extra bone in the skeleton, to be used from this "bank" when production commences. During this stage the growing pullets should have shell grit or non-dolomitic limestone grit before them

at all times. Should the pullets be housed intensively, proper absorption and utilisation of calcium and phosphorus cannot take place unless cod-liver oil or a fish-oil emulsion containing vitamin D3 is added to the ration.

Adequate Feeding Space for all Age Groups.

Unless chickens have enough "elbow room" at the feed hopper, the full beneficial effect of a correct feeding programme and brooder and weaning technique cannot be realised. Too little feeding space results in an unruly, heaving mass of jostling chickens. The bigger ones, by virtue of their size and possible aggressiveness, are "first in and first served." The smaller chickens, when they do manage to get to the hopper, may only have sufficient time for a few beakfuls of mash which has been picked over by the stronger chickens, before they are chased away by bullies. Over a period of time, inadequate feeding space can cause much unevenness in size and development of a growing flock. The following amounts of feeding space for various age groups are necessary :—day-old to 3 weeks of age, 10 linear feet ; 4 weeks to 6 weeks of age, 20 linear feet (or 10 feet of a double-sided hopper length) ; and 7 weeks onwards, 30 linear feet (or 15 feet of double-sided hopper length).

COMMON NAMES OF GRASSES.

The following are the standard common names recently adopted or confirmed by agricultural authorities throughout Australia for some native and introduced grasses found in Queensland. The names are taken from "Standardized Plant Names," Bulletin No. 272 of the Commonwealth Scientific and Industrial Research Organization.

Botanical Name.	Standard Common Name.
Alloteropsis semialata	Cockatoo grass
Aristida arenaria	Kerosene grass
Aristida latifolia	Feather-top wire grass
Aristida leptopoda	White spear grass
Astrebla elymoides	Hoop Mitchell grass
Astrebla lappacea	Curly Mitchell grass
Astrebla pectinata	Barley Mitchell grass
Astrebla squarrosa	Bull Mitchell grass
Axonopus affinis	Narrow-leaf carpet grass
Axonopus compressus	Broad-leaf carpet grass
Bothriochloa ambigua	Red-leg grass
Bothriochloa decipiens	Pitted blue grass
Bothriochloa ewartiana	Desert blue grass
Bothriochloa intermedia	Forest blue grass
Brachiaria foliosa	Leafy panic
Brachiaria miliiformis	Green summer grass
Brachiaria mutica	Para grass
Cenchrus australis	Hillside burr grass
Cenchrus ciliaris	Buffel grass
Cenchrus echinatus	Mossman River grass
Cenchrus pauciflorus	Spiny burr grass
Cenchrus pennisetiformis	Slender buffel grass
Cenchrus setigerus	Birdwood grass
Cenchrus tribuloides	Dune sand burr or Innocent weed
Chloris acicularis	Curly windmill grass
Chloris barbata	Purple-top chloris
Chloris divaricata	Slender chloris
Chloris truncata	Windmill grass
Chloris ventricosa	Tall chloris
Chloris virgata	Feather-top Rhodes grass



The 1953 Baconer Carcass Competitions.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE championship in the 1953 Baconer Pig Carcass Competition conducted by the Australian Meat Board in Queensland was awarded to Mr. R. S. Postle, "Yaralla," Pittsworth, for a purebred Large White carcass which secured a record Queensland score of 89½ points. The carcass was nicely proportioned and of good type. It scored well in all points, but a more finished appearance would have been presented had there been slightly more fat development.

Results.

Prize-winners in their respective districts were as follows :—

Prize.	Owner.	Breed.	Weight.	Points.
			Lb.	
	North Queensland (Judged at Mareeba).			
1st	W. Hastie and Sons	Berkshire	120	88½
2nd	W. Hastie and Sons	Berkshire	135	88
3rd	P. J. Neal	Wessex Saddleback x Large White/Berkshire	140	87
	Central Queensland (Judged at Rockhampton).			
1st	D. and L. Keleher ..	Wessex Saddleback x Large White	129	89
2nd	E. E. C. Goodland ..	Large White	142	80
3rd	F. N. and G. Baxter	Berkshire	138	79½
	Darling Downs (Judged at Toowoomba).			
1st	R. S. Postle ..	Large White	150	89½
2nd	L. and H. Koch ..	Berkshire x Large White ..	164	85½
3rd	C. H. Ingleton ..	Large White x Berkshire / Large White	128	85
	South Queensland (Judged at Brisbane).			
1st	S. Schulz	Large White x Berkshire ..	129	89
2nd	H. L. Larsen ..	Large White	134	86
3rd	H. W. Schimke ..	Berkshire	158	85½

Comments.

As usual, field days were held to coincide with the judging at each centre, and attendances were good at all places except Brisbane.

TABLE 1.

AVERAGE FOR EACH SECTION OF JUDGING.

Section.	Possible Points.	1948.		1949.		1950.		1951.		1952.		1953.	
		Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.	Average Points Obtained.	Percentage of Possible Points.
By Inspection—													
Hams	8	5·604	70·050	6·27	78·40	6·097	76·213	6·44	80·52	6·286	78·571	6·67	83·37
Shoulders	7	5·562	78·029	5·92	84·57	5·849	83·564	5·92	84·60	5·947	84·959	6·02	86·00
Streak	12	6·764	56·367	5·57	46·40	7·766	64·724	7·41	61·79	6·982	58·185	8·29	69·08
By Measurement—													
Eye Muscle Thickness	28	11·775	58·875	18·04	64·42	14·262	50·936	20·15	71·96	19·114	68·265	19·15	68·39
Backfat Thickness	20	15·489	77·445	15·26	76·30	14·572	72·864	15·45	77·23	14·729	73·643	15·97	79·85
Body Length ..	20	12·500	44·643	13·06	65·30	13·388	66·941	12·98	64·92	14·814	74·072	14·99	74·95
Leg Length ..	5	3·111	62·220	3·02	60·40	3·281	65·631	3·21	64·22	2·757	55·142	3·27	65·40
Total	100	60·805		67·97		65·218		71·57		70·629		74·87	



Plate 1.
Winning Entries in the Northern District.

To qualify for entry into the competition, the pig must have been sired by a purebred boar and the dressed carcass was required to weigh not less than 120 lb. and not more than 180 lb. Entries totalled 160, of which nine were disqualified (8 underweight and 1 a rig).

The 1st class certificate was gained by 79·47% of the competing carcasses, the 2nd class by 17·22%, leaving only 3·31% receiving no recognition. These figures indicate the high standard attained by the competitions. A further analysis of the results shows that 25·83% secured 80 points or better, 53·64% 70 points and over, 17·22% 60 points and over, and 3·31% under 60 points.

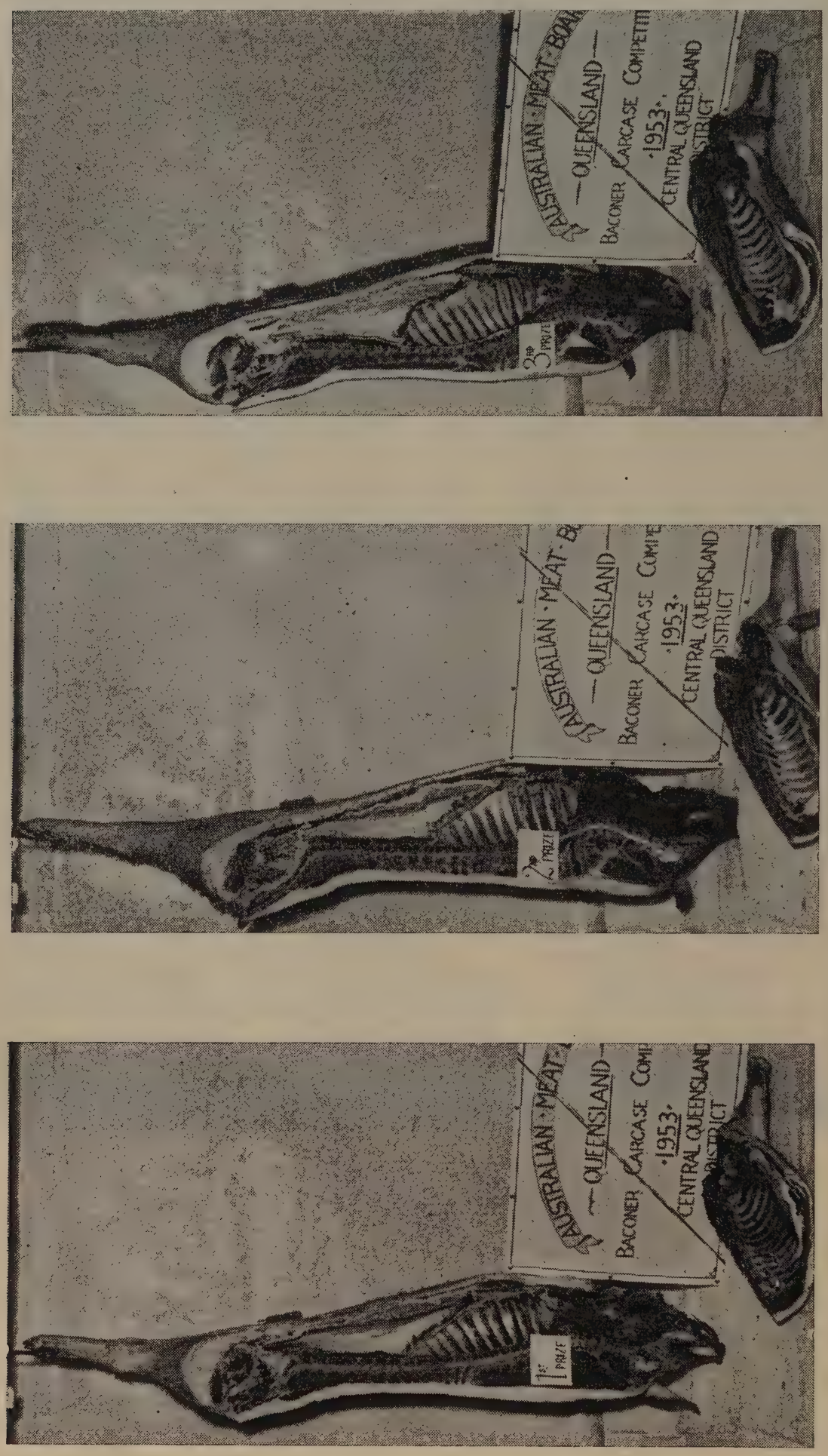
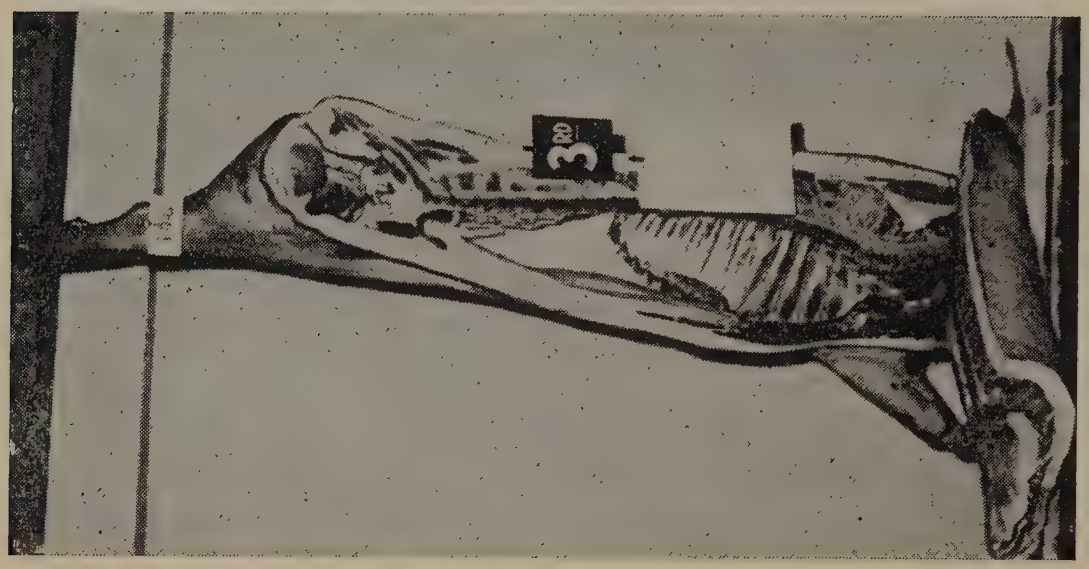


Plate 2.

Winning Entries in Central Queensland.

Plate 3.

Winning Entries in the Darling Downs District.



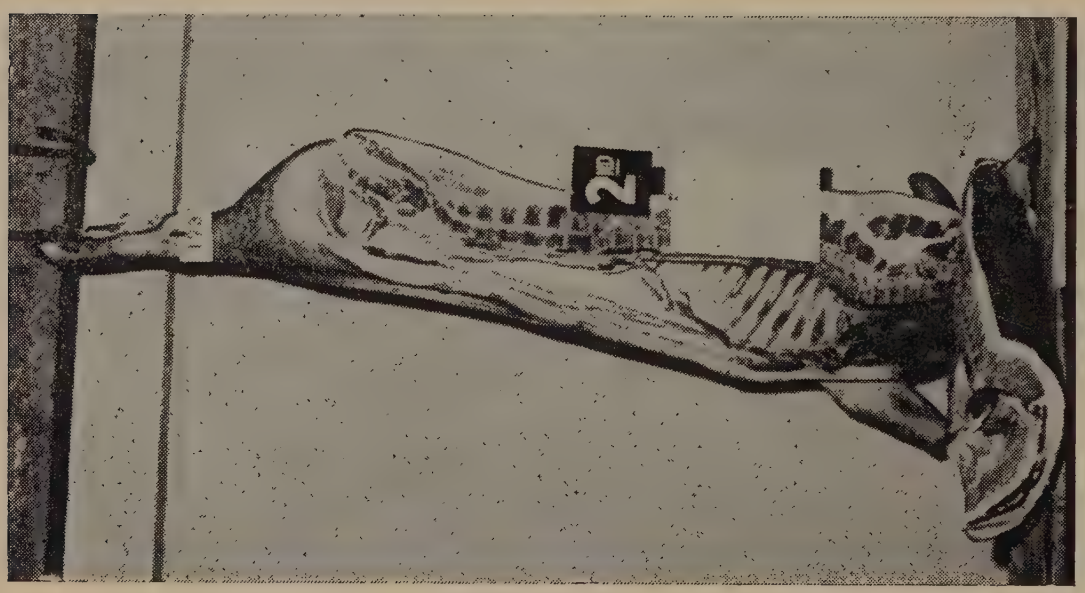




Plate 4.
Winning Entries in South Queensland.

The top score of 89½ points is the highest so far registered in any of the competitions, as is also the average score of 74·87%. A perusal of the average score in each section of the judging (Table 1) reveals an improvement in all sections, though eye muscle thickness and backfat thickness, both important features, are still capable of improvement.

Hams showed a marked improvement, there being less shank and better fleshing.

There was an apparent improvement in shoulder development in all districts except South Queensland, where shoulders appeared in the main to be heavy.

Streak or belly scored well, with a greater proportion of good streaks in evidence than in previous years. However, there is still too large a proportion of overfat and thin streaks.

Eye muscle thickness scored reasonably well. The proportion of really well developed eye muscles is, however, still small, the majority scoring between half and three-quarters of the maximum points.

The absence of excessively overfat carcasses was again noticeable, there being a larger proportion of entries measuring less than standard for backfat.

Body length scored particularly well, indicating a steady improvement. Full points for measurements equal to or greater than the standard were scored by 13 carcasses in North Queensland, 6 in Central Queensland, 2 in the Darling Downs and 9 in South Queensland. Up to 33 mm. in excess of the standard was recorded.

Leg length also showed evidence of some improvement, 27·8% of all carcasses scoring full points. There appears to be still a tendency for breeders to overlook the importance of leg length.

CARE NEEDED WITH PERENNIAL SORGHUM.

While a new perennial sorghum (*Sorghum almum*) shows promise of being a hardy plant in the drier parts of Queensland, farmers and graziers are advised to be cautious in planting and using it, as Departmental tests have shown that it may carry a considerable amount of prussic acid.

Perennial sorghum is a natural hybrid of Johnson grass and Sudan grass and has the tall, luxuriant growth characteristic of Sudan grass combined with the perennial nature of Johnson grass. Its seed germinates readily wherever it is dropped or scattered, even on hard soil.

While controlled grazing reduces the risk of poisoning from annual sorghums such as Sudan grass, grazing is much more difficult to handle in large paddocks of permanent pasture in which perennial sorghum may become established. For this reason, care should be taken with plantings until such time as it is known whether the plant can be safely handled under grazing conditions.

A Pig Breeding and Feeding Programme for the Dairy Farm.

F. BOSTOCK, Officer in Charge, Pig Branch.

Where pig production is largely dependent on the dairying activities of a farm, careful planning of production is necessary to ensure that the dairy by-product, skim milk, is used to the best advantage. The farmer should as far as possible avoid being caught with an insufficient number of pigs to cope with the flush of skim milk; on the other hand, he should not be caught with a large number of pigs on the farm when skim milk is in short supply.

The following table has been drawn up to assist farmers in planning their pig raising operations. It applies to a 30-cow dairy farm, but dairy farmers with fewer or more cows will be able to use it as a guide. By following such a programme in a normal season, the farmer can obviate the purchase of stores during the flush of milk production and the sale of unfinished pigs because of insufficient feed.

The provision of green roughages is quite important in the feeding of pigs, and an endeavour should be made to have such crops available throughout the year for grazing, cutting or digging. For winter and spring green feed a succession of sowings should be commenced in February, using wheat, oats, barley, rape or other suitable green crop. In normal seasons if fed judiciously these will provide green feed through to early summer, when early spring plantings of millets would normally be ready for feeding. Wherever possible, lucerne should be available for grazing, and sweet potatoes also should feature for both grazing and hand-feeding of the tubers.

In calculating the amounts of fodder crops to be fed from November through to June, note that the column of "Fodder Crops Grain Equivalent" gives the numbers of pounds of "grain equivalent" which should be fed. For example, in December No. 1 sow needs 4 lb. grain equivalent, which is given by 16 lb. of sweet potatoes or 28 lb. of pumpkins if these foodstuffs are available.

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (*See* note at end).	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
July	No. 1 sow farrowed 5th July ..	As available	1	5	Grazing Green feed cut	Wheat, barley, oats, rape, grazing lucerne as available
	No. 2 sow with litter		1¼	7		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 porkers from No. 3 sow		¼	4		
	6 slips from No. 4 sow		¼	2		
	Daily Total		7¼	52		
	Total for 31 days		224¾	1,612		

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (*See* note at end).	Suggested Crops when Available.
August	No. 1 sow with litter	As available	1¼	7	Grazing Green feed cut	Wheat, barley, oats, rape, mangolds, grazing lucerne as available
	No. 2 sow mated 10th August ..		¼	2		
	No. 3 sow dry		¼	2		
	No. 4 sow dry		¼	2		
	6 weaners from No. 2 sow ..		½	1		
	6 light baconers from No. 3 sow ..		¼	5		
	6 porkers from No. 4 sow		¼	4		
	Daily Total		8	73		
	Total for 31 days		248	2,263		
September	No. 1 sow mated 10th September ..	..	¼	2	Grazing Green feed cut	Wheat, barley, oats, mangolds, grazing lucerne as available
	No. 2 sow dry	..	¼	2		
	No. 3 sow farrowed 5th September	1	½	5		
	No. 4 sow dry	..	¼	2		
	6 weaners from No. 1 sow ..	1	..	1		
	6 slips from No. 2 sow	1	..	2		
	6 baconers from No. 3 sow (sell) ..	1	..	6		
	6 light baconers from No. 4 sow ..	1	..	5		
	Daily Total	25	1¼	95		
	Total for 30 days	750	37½	2,850		
October	No. 1 sow dry	1	..	2	Grazing Green feed cut	Lucerne, mangolds, grazing lucerne as available
	No. 2 sow dry	1	..	2		
	No. 3 sow with litter	3	..	7		
	No. 4 sow farrowed 5th October ..	3	..	5		
	6 slips from No. 1 sow	1	..	2		
	6 porkers from No. 2 sow	1	..	4		
	6 baconers from No. 4 sow (sell) ..	1	..	6		
	Daily Total	26	..	88		
	Total for 31 days	806	..	2,728		
November	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow mated 10th November..	1	..	1	4	
	No. 4 sow with litter	3	..	5	8	
	6 porkers from No. 1 sow	2	..	2	8	
	6 light baconers from No. 2 sow ..	2	..	2	12	
	6 weaners from No. 3 sow ..	2	..	½	2	
	Daily Total	42	..	35	152	
	Total for 30 days	1,260	..	1,050	4,560	

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meat Meal.	Grain.	Fodder Crops Grain Equivalent. (*See* Note at End.)	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
December	No. 1 sow dry	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow farrowed 5th December	2	..	3	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow mated 10th December	1	..	1	4	
	6 light baconers from No. 1 sow	2	..	2	12	
	6 baconers from No. 2 sow (sell)	2	..	3	12	
	6 slips from No. 3 sow	2	..	1	4	
	6 weaners from No. 4 sow	2	..	½	2	
	Daily Total	53	..	45	200	
	Total for 31 days	1,643	..	1,395	6,200	
January	No. 1 sow farrowed 5th January	2	..	2	8	Millet, sweet potatoes, pumpkins maize, cowpeas, grazing lucerne as available
	No. 2 sow with litter	3	..	5	8	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 baconers from No. 1 sow (sell)	2	..	3	12	
	6 porkers from No. 3 sow	2	..	2	8	
	6 slips from No. 4 sow	2	..	1	4	
	Daily Total	43	..	45	168	
	Total for 31 days	1,333	..	1,395	5,208	
February	No. 1 sow with litter	3	..	5	8	Millet, sweet potatoes, pumpkins, maize, cowpeas grazing lucerne as available
	No. 2 sow mated 10th February	1	..	1	4	
	No. 3 sow dry	1	..	1	4	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 2 sow	2	..	½	2	
	6 light baconers from No. 3 sow	2	..	2	12	
	6 porkers from No. 4 sow	2	..	2	8	
	Daily Total	42	..	35	152	
	Total for 28 days	1,176	..	980	4,256	
March	No. 1 sow mated 10th March	1	..	1	4	Millet, sweet potatoes, pumpkins, maize, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow farrowed 5th March	2	..	3	8	
	No. 4 sow dry	1	..	1	4	
	6 weaners from No. 1 sow	2	..	½	2	
	6 slips from No. 2 sow	2	..	1	4	
	6 baconers from No. 3 sow (sell)	1	..	3	12	
	6 light baconers from No. 4 sow	1	..	2	12	
	Daily Total	41	..	45	200	
	Total for 31 days	1,271	..	1,395	6,200	

SUGGESTED BREEDING PLAN AND FOOD REQUIREMENTS OF PIGS ON A 30-COW HERD DAIRY FARM.—*continued.*

Month.	Stock.	Separated Milk.	Meatmeal.	Grain.	Fodder Crops Grain Equivalent. (*See* note at end).	Suggested Crops when Available.
		Gal.	Lb.	Lb.	Lb.	
April	No. 1 sow dry	1	..	1	4	Sweet potatoes, pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	4	
	No. 3 sow with litter	3	..	5	8	
	No. 4 sow farrowed 5th April ..	2	..	2	8	
	6 slips from No. 1 sow	2	..	1	4	
	6 porkers from No. 2 sow	1	..	2	8	
	6 baconers from No. 4 sow (sell) ..	1	..	3	12	
	Daily Total	31	..	45	168	
	Total for 30 days	930	..	1,350	5,040	
May	No. 1 sow dry	1	..	1	7	Pumpkins, maize, arrowroot, cowpeas, grazing lucerne as available
	No. 2 sow dry	1	..	1	7	
	No. 3 sow mated 10th May ..	1	..	1	7	
	No. 4 sow with litter	2	..	6	7	
	6 porkers from No. 1 sow (sell) ..	1	..	3	7	
	6 light baconers from No. 2 sow (sell)	1	..	4	7	
	6 weaners from No. 3 sow ..	1	..	1	..	
	Daily Total	23	..	57	112	
	Total for 31 days	713	..	1,767	3,472	
June	No. 1 sow dry	1	..	1	7	Pumpkins, arrowroot, rape, grazing lucerne as available
	No. 2 sow farrowed 5th June ..	2	..	4	7	
	No. 3 sow dry	1	..	1	7	
	No. 4 sow mated 10th June ..	1	..	1	7	
	6 slips from No. 3 sow	1	..	1	7	
	6 weaners from No. 4 sow ..	1	..	1	..	
	Daily Total	17	..	19	70	
	Total for 30 days	510	..	570	2,100	

NOTE.—Grain equivalent : 1 lb. grain = 4 lb. sweet potatoes ; 5 lb. arrowroot 7 lb. pumpkins ; 10 lb. green forage.

Brucellosis Testing of Swine.

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

TESTED HERDS (As at 15th November, 1953).

Berkshire.

J. J. Bailey, "Lucydale" Stud, East Greenmount
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
R. G. Koplick, "Melan Terez" Stud, Rochedale
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Bardell," Goovigen
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, "Felbar" Stud, Kalbar
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood

Large White.

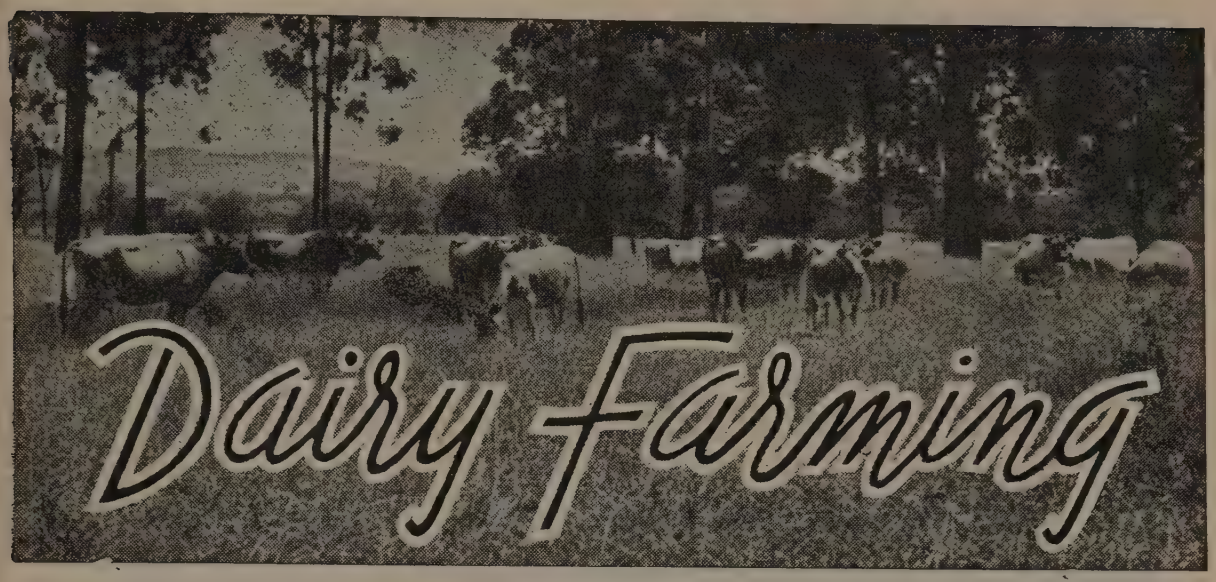
H. J. Franks and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. G. Koplick "Melan Terez" Stud, Rochedale
R. Postle, "Yarralla" Stud, Pittsworth
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. T. Fowler, "Kenstan" Stud, Pittsworth
H. L. Larsen, "Oakway," Kingaroy
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
E. G. Evans, "Lauraven" Stud, Box 22, Maleny
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai" Stud, Clifton

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
R. G. Koplick, "Melan Terez" Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
G. H. Sattler, Landsborough

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
M. E. Bryant, "Maryland Brae" Stud, Blunder road, Oxley
A. H. Groves, "Kinvara" Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea" Stud, Murgon



The Manufacture of Cheddar Cheese in Queensland.

E. B. RICE and T. A. MORRIS, Division of Dairying.

(*Continued from page* 284 *of the November issue.*)

Pasteurisation of Milk for Cheddar Cheese Making.

Owing to the varying quality of the milk received and the high atmospheric temperatures in the subtropical climate, particularly during the summer months, pasteurisation of milk may be regarded as essential for the manufacture of cheese in Queensland.

The milk is normally flash pasteurised in regenerative double-dome or plate types of pasteuriser. The double-dome type (Plate 5) has to be connected to a separate cooler for reducing the temperature of the milk to that required in the vat, whereas with the plate machine (Plate 6) pasteurisation and cooling are performed fully enclosed in the one unit.

Operation of the Pasteuriser.

The principles involved in the operation of a pasteuriser for cheese-milk are independent of the type of machine employed. In general the procedures are as follows :—

Sterilizing and Starting.

Before pasteurising begins the machine is sterilized by pumping a chlorine solution through it or by circulating water at a temperature of 180–185° F. for about 5 minutes.

When sufficient milk is available, and with the return to the receiving vat open, the milk flow is commenced. Water is turned on to the cooling section and steam is slowly turned on to the heating section of the pasteuriser. The steam supply is increased until the thermometer registering the temperature of the hot milk indicates that the desired temperature is being attained. The thermometer registering the temperature of the cooled milk is read, and if necessary the flow of cooling water is adjusted until the correct milk temperature is attained.

When the temperatures are steady at the desired levels the by-pass to the receiving vat is closed by the opening of the line to the cheese vats.

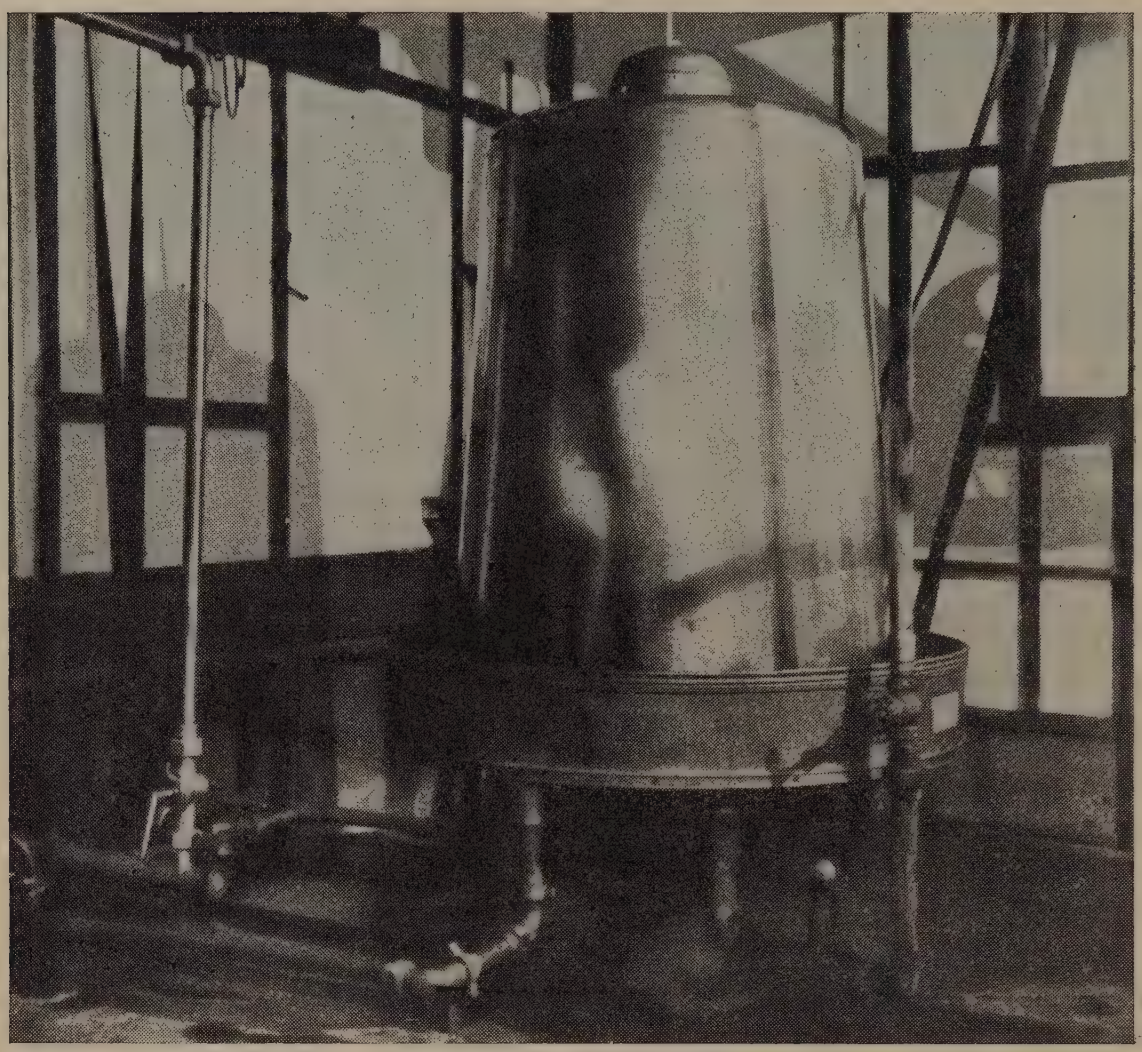


Plate 5.

A Dome Pasteuriser. This type has to be connected to a separate milk cooler.

Running.

The running of the pasteuriser involves maintaining a supply of milk and controlling the heating and cooling temperatures. Cheese-milk pasteurisers are usually manually operated and the control of the pasteurising temperature is by direct adjustment of the steam valve. The steam-line to the machine should be fitted with a reducing valve and should not be lagged. This will ensure a steady supply of low pressure, wet steam and thus facilitate the holding of steady temperatures as well as minimise the amount of burning-on of the milk in the heating section. Where the steam-line to the pasteuriser is short it might be necessary to bend it back on itself to provide a sufficient length of unlagged pipe-line to allow adequate condensation of the steam. Hot water circulating sets similar to those used with ordinary milk pasteurisers are being used in some instances. They are found to reduce both the amount of supervision required during pasteurising and, because of the absence of burnt-on milk, the labour involved in cleaning the machine.

If it becomes apparent that the pasteuriser will be without milk flow for a short time (for example, as a result of a delay in milk reception), the by-pass to the receiving vat may be opened and the milk then circulated until sufficient is on hand to allow a continuation of the filling of the cheese vats. For longer stoppages the milk should be followed through with water and the machine should then be closed down and left filled with water until pasteurising can be recommenced. If the machine is allowed to drain during such stoppages the milk deposits will dry out and be very difficult to remove.

Stopping.

The last of the milk is followed through with water from a specia balance tank or the receiving vat. As soon as the milk running into the cheese-vat appears watery the flow is diverted to allow it to run to waste. The steam is turned off and the pump supplying the cooling water is stopped. The cleaning of the pasteuriser may now be proceeded with.

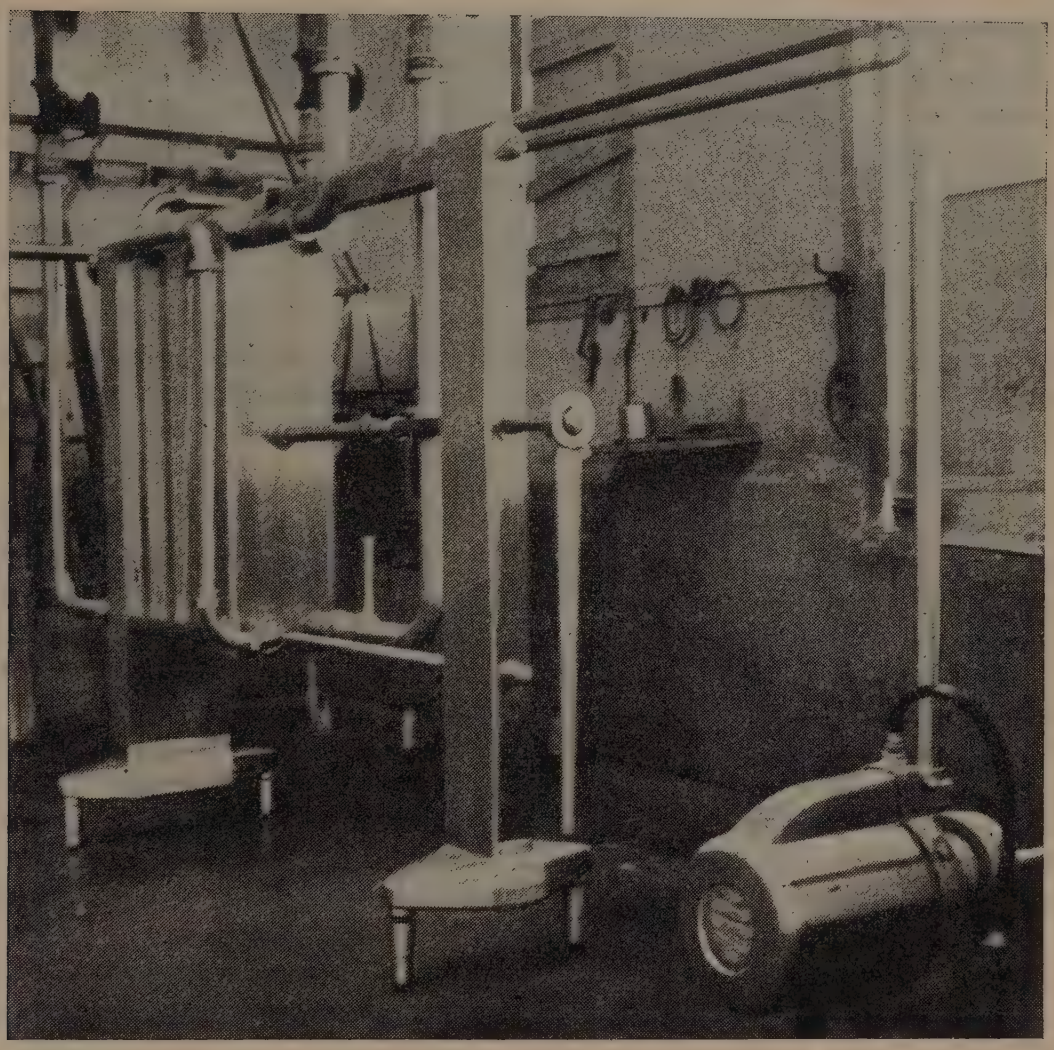


Plate 6.

A Plate Pasteuriser and Cooler. Pasteurisation and cooling of the milk are carried out fully enclosed in the one machine.

Advantages of Pasteurisation.

The advantages of pasteurisation may be listed as follows :—

(1) Pasteurisation greatly simplifies the bacterial flora of the milk, as only heat-resistant organisms survive. Thus most of the natural souring organisms and many of the organisms which may produce off flavours and openness in cheese are eliminated or at least reduced below the level of importance. Therefore, this practice allows a reasonably standardised starting point so that the cheesemaker can more easily attain uniformity in his cheese.

(2) Cheese made from pasteurised milk has a cleaner and better average flavour than raw-milk cheese and has superior keeping qualities. Some feed flavours are eliminated or reduced.

(3) A slightly increased yield is brought about by reduction of fat losses and precipitation of some of the whey-soluble protein.

(4) The heating of milk results in the formation of certain substances which stimulate the growth of lactic acid bacteria.

Effects of Pasteurisation on the Cheesemaking Process.

Only minor changes of technique are needed in the manufacture of pasteurised-milk cheddar in comparison with raw-milk cheddar.

Where poorly produced milk is being handled, pasteurisation simply makes the best of a bad job, and dirty milk may still contain large numbers of undesirable organisms even after efficient pasteurisation. The by-products of bacterial activity prior to pasteurisation also remain after the milk is pasteurised. High-acid milk (over 0·25 per cent. acidity) will not pasteurise, as the high temperature will result in coagulation of the milk.

The temperature to which cheese milk may be flash pasteurised varies according to seasonal conditions (drought, wet season, etc.), which directly affect the percentage of total solids and vary the fat : casein ratio. Temperatures may also require attention to deal with early and late lactation milk. The usual range in Queensland is 155–162° F.

Slower curdling with rennet may be noticed, particularly if the temperature of pasteurisation exceeds 160° F., but this is easily remedied. The curdling of milk with rennet requires the presence of soluble calcium salts ; certain of these salts are precipitated by the action of heat, and if milk is heated to too high a temperature coagulation may be slower. Overheating also results in a soft mushy curd, poor drainage, and a weak-bodied cheese. The soluble calcium salts may be replaced by the addition of calcium chloride or dilute hydrochloric acid before renneting. Calcium chloride is added to the milk at the rate of 1–3 oz. per 100 gallons of milk. It should be dissolved in 10 times its weight of water and added by a drip method as the milk is entering the making vat, or direct to the vat of cheese milk.

Hydrochloric acid is used at the rate of 3–5 oz. per 100 gallons of milk. It should be diluted with 10–20 times its weight of water and added by the drip method as the milk is entering the making vat. The hydrochloric acid dissolves some of the precipitated calcium salts, thus increasing the amount of soluble calcium present.

Calcium chloride is usually preferable to hydrochloric acid in obtaining faster coagulation and a firmer curd. Many naturally soft-curd milks are improved by the addition of calcium chloride.

Because of the destruction of lactic acid bacteria, it is necessary to use a greater amount of starter for pasteurised milk. A pure active starter is essential.

The disadvantage of pasteurised milk cheddar is the slightly reduced rate of ripening in comparison with raw-milk cheddar. The *Lactobacillus* species of organisms (which are important in the latter ripening stages of cheddar) are reduced by pasteurisation, but sufficient survive for proper ripening, although it takes place at a slightly slower rate.

[TO BE CONTINUED.]

Agricultural Chemistry

The Structure of Soils.

F. CHIPPENDALE, Senior Soils Technologist.

A GOOD concrete is made up of a mixture of coarse, medium and fine particles so that when mixed, rammed and set there are few air bubbles and the mass is hard and almost impervious to water. Should the fines be left out of the mix, then the final mass has numerous air spaces and is relatively porous.

In the same way, a soil composed entirely of coarse particles always has a reasonable amount of pore space which can only be reduced by grinding up some of the coarser material or introducing fine particles from an outside source.

Since the normal soil contains an infinite variety of particle sizes, it is possible to get it to form a very compact mass which has little space for the air and water required by plants. This happens when a soil is puddled by working it in an over-wet condition or when it is cultivated in a dry state by an implement which mechanically destroys the structure.

Aggregates.

The term structure is used to denote the grouping together of a number of the ultimate soil particles into an aggregate. These aggregates may vary in size from a clod to very fine grains. The ideal structure to give best conditions for plant growth is considered to be strongly developed crumbs.

This means that although the soil may contain a large number of particles too small to be seen even with the aid of a strong lens, many of these have stuck together and to the coarser particles until the mass has the appearance of bread crumbs. As each crumb has minute spaces that can hold water and there is ample space between crumbs for air, this soil can well support plant growth.

On the other hand, some soil types (for structure is a characteristic of a soil type) may be structureless. They may then be either powdery (when the bulk of the individual particles may be fine sand or silt ranging from 1/125th to 1/12,500th of an inch in diameter), or massive, if there is a high proportion of clay present. In the latter case, the soils can be like a lump of plasticine when moist but on drying out form huge clods which are difficult to deal with in a cultivation.

Cementing Materials.

The force with which aggregates are held together depends on the cementing material. It may be organic matter (such as fungous strands), clay or substances such as oxides of iron and manganese.

If clay is the cementing material, the strength of the aggregate can still depend on the type of clay present. Dark-coloured Darling Downs soils have a clay which is capable of holding a large proportion of calcium and so can retain a good structure, often in spite of misuse.

The red loams of the rain forests, on the other hand, have a good crumb structure which is due largely to organic matter. When the original high amount of organic matter has been used up because of repeated cultivation, the structure is poor though the same amount of clay remains in the soil. This type of clay cannot retain large quantities of lime, and apart from restoring the organic matter an excess of lime would be needed to improve the structure.

Stability of Soil Aggregates.

To be of most value, therefore, aggregates must be capable of withstanding cultivation and the action of water. This is referred to as stability. An index of the stability of the soil structure can be obtained in the laboratory by subjecting a soil sample to repeated washings on a set of standard sieves. The amounts of soil retained on the various sized sieves are a measure of the water-stable aggregates. The difficulty is to obtain a suitable soil sample. It is essential to take the sample without destroying any of the aggregates and to do this special precautions are necessary. Special skill is required also in selecting a suitable sampling site.

The water-stable aggregate figure is a useful quantity to know for any soil type, for besides being a characteristic of the particular soil type it is of value in recommending suitable rotations and cultivation techniques and in assessing the erosion potential of that soil. A structure which slakes on wetting makes cultivation difficult and makes erosion a certainty if slope and cover are favourable to the surface movement of water.

With a good agricultural soil the aim must therefore be to retain or improve the stability of the aggregates. This can best be done by cultivating over the correct moisture range—neither too wet nor too dry—and using long rotations. Permanent pastures can usually maintain a structure indefinitely, while intensive row cropping can result in a rapid deterioration of structure.

Stability can be destroyed by mechanical means, chemical changes or biological action. Examples of these three actions are—

(1) The use of too heavy equipment.

(2) The replacement of lime in clay by excessive amounts of sodium (from saline waters or nitrate of soda) or ammonium (from sulphate of ammonia); high temperature, such as in the light-coloured sandy soils of the coastal strip.

(3) The using up of vegetable remains by lower organisms which provide no cementing material to replace that which they destroy.

Restoring Stability.

Stability can be restored in many instances by a method of soil husbandry, such as changing from continuous cropping to a ley-farming system, or merely lengthening a rotation to ensure that row crops are not planted more than once in any year.

A more rapid and therefore often spectacular method of restoring stability is by applying a food such as molasses for the micro-organisms or one of the recently released soil conditioners. The action of molasses depends on suitable fungi or bacteria being present in the soil, while the soil conditioners require a relatively high percentage of clay to be present and do not act the same on all types of clay. They have been tried on several soil types of the Brisbane area and on the heavier Burdekin Valley soils with good results, but as yet they are too expensive for use on a large scale.

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